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ABSTRACT

Economic Impacts of Employment Shifts in Michigan's Metro and Nonmetro Areas: 1978-1987

By

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Trends in industrial transformation in Michigan's metropolitan and nonmetropolitan counties between 1978 and 1987 are examined. The spatially and temporally varying associations of employment specialization in manufacturing, wholesale and retail trade, and FIRE with real income per capita is also analyzed. Results indicate that a sectoral shift from manufacturing to services is occurring, but Michigan still remains more dependendent on manufacturing than the nation as a whole. The industrial structure varied between metropolitan and nonmetropolitan counties. Counties specialized in manufacturing employment were predominantly metropolitan or nonmetropolitan adjacent, while counties specialized in wholesale and retail trade employment were predominantly nonmetropolitan. One half of the metropolitan counties were specialized in FIRE employment, while only a quarter of the nonmetropolitan counties were. Regression analysis indicated that specialization in manufacturing and FIRE employment associated with higher income per capita, while specialization in wholesale and retail trade employment associated with lower income per capita.

to my parents, who taught me that anything
worth having was worth working for

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TABLE OF CONTENTS

List of Tables..... vi
List of Figures..... viii

CHAPTERS

I. INTRODUCTION..... 1
1.1 Industrial Restructuring in the United States 3
1.2 Gaps in the Literature..... 6
1.3 Purpose..... 8
1.4 Data..... 9

II. LITERATURE REVIEW..... 13
2.1 Industrial Shifts in the United States.... 14
2.2 Socio-Economic Consequences of Industrial Restructuring..... 18

III. ECONOMIC TRANSFORMATION IN MICHIGAN..... 23
3.1 Industrial Structure in Michigan..... 27
3.2 Industrial Diversification..... 39
3.3 Employment Specialization..... 42
3.4 Summary..... 50

IV. ANALYSIS..... 53
4.1 Spatial Variation..... 54
4.2 Temporal Variation..... 55
4.3 Results..... 56

V. CONCLUSIONS..... 61

APPENDICES..... 66

BIBLIOGRAPHY..... 76

LIST OF TABLES

Table

3.1 Metropolitan-Nonmetropolitan Variation in Per Capita Income, 1978 and 1987..... 23

3.2 Change in Real Per Capita Income by County, 1978 to 1987..... 24

3.3 Pearson Correlation Coefficients for Income and Earnings per Capita in Michigan, 1978..... 26

3.4 Pearson Correlation Coefficients for Income and Earnings per Capita in Michigan, 1987..... 26

3.5 Pearson Correlation Coefficients for Income and Earnings per Capita in Nonmetropolitan Counties in Michigan, 1978..... 26

3.6 Pearson Correlation Coefficients for Income and Earnings per Capita in Nonmetropolitan Counties in Michigan, 1987..... 27

3.7 Percent Distribution of Employment and Establishments for the United States and Michigan, 1978 and 1987..... 28

3.8 Percent Distribution of Employment by Industry Type, 1978 and 1987..... 30

3.9 Percent Distribution of Establishments by Industry Type, 1978 and 1987..... 31

3.10 Change in Employment by County Type 34

3.11 Change in Establishment by County Type..... 35

3.12 Change in High Tech Employment and the Number of High Tech Establishments in Michigan Between 1978 and 1987..... 36

3.13 High Tech Manufacturing as a Percentage of All Manufacturing, 1978 and 1987..... 36

3.14 Employment Change in Selected SIC Categories 38

3.15 Change in Relative Entropy Between..... 41

3.16 Geographic Distribution of Counties with Location Quotients Greater than One in 1978... 48

3.17 Geographic Distribution of Counties with Location Quotients Greater than One in 1987... 48

3.18 Change in the Average Location Quotients..... 49

3.19 Metropolitan-Nonmetropolitan Variation in Employment Specialization, 1978 and 1987..... 50

4.1 Pearson Correlation Matrix for 1978 Equations 54

4.2 Pearson Correlation Matrix for 1987 Equations 54

4.3 Metro-Nonmetro Variation in the Association Between Employment Specialization and Income per Capita..... 57

4.4 Temporal Variation in the Association Between Employment Specialization and Real Income per Capita..... 59

Appendix A Change in Employment Entropy by County 66

Appendix B Change in Establishment Entropy by County 68

Appendix C (a) Change in Location Quotients for Manufacturing by County..... 70

Appendix C (b) Change in Location Quotients for Wholesale and Retail Trade by County 72

Appendix C (c) Change in Location Quotients for FIRE by County..... 74

LIST OF FIGURES

Figure

1.1 Metro-Nonmetro Classification of Michigan Counties 10

3.1 Location Quotients: Wholesale and Retail Trade.... 44

3.2 Location Quotients: Manufacturing..... 46

3.3 Location Quotients: Finance, Insurance, and Real Estate..... 47

CHAPTER ONE

INTRODUCTION

Industrial transformation is a process involving changes in industrial structure and output. In the United States, this transformation is often defined as a reorganization within manufacturing industries and a growth in service industries. Improvements in transportation, communication, production technology, and the development of a global reservoir of employment have allowed manufacturing firms to spatially reorganize modes of production (Bradbury, 1985; Young, 1986). Industrial transformation in the United States has involved four types of spatial changes: the movement of industries from city to suburb; Industrial Heartland to Sunbelt; metropolitan to nonmetropolitan areas; and relocation of industries to foreign countries (Noyelle and Stanback, 1983; Young, 1986; Haynes and Machunda, 1987; Markusen and Carlson, 1989; Esparza, 1990; Moriarty, 1991; Ray, 1992).

It was anticipated that regional shifts in manufacturing within the United States would result in a reduction of interregional inequality; however that has not occurred (Glickman and Glasmeier, 1989). Instead, the process of industrial transformation has increased intermetropolitan inequality within and between U.S. census regions and income inequality between U.S. metropolitan and nonmetropolitan areas (Amos, 1989; Barancik, 1990; Angel and Mitchell, 1991; Deavers, 1991).

In the Industrial Heartland the transformation to a service economy and the spatial reorganization of production has resulted in manufacturing employment losses at a much greater scale than anywhere else in the United States (Markusen and Carlson, 1989; Connaughton and Madsen, 1990). Job loss in the Great Lakes region accounted for half of all jobs lost in the nation between 1979 and 1986 (Markusen and Carlson, 1989). Between 1963 and 1986, this region also experienced an overall decline in manufacturing output and a below average annual growth rate in total Gross Regional Product (Connaughton and Madsen, 1990). Service sector output increased between 1963 and 1986 in the Industrial Heartland, but did not offset the loss in manufacturing output especially in Illinois, Indiana, Michigan, Ohio, and Wisconsin (Connaughton and Madsen, 1990; Goe, 1990).

In this study, trends in industrial transformation in Michigan's metropolitan and nonmetropolitan counties between 1978 and 1987 are examined; in addition, the spatial and temporal associations of sectoral employment specialization with economic indicators are analyzed. The following sections include a brief review of industrial restructuring and its impact on the labor market in the United States, gaps in the literature, a statement of purpose, and data description.

1.1 Industrial Restructuring in the United States

In the United States corporate profits began falling in the mid 1960's, as rising taxes and labor costs increased production costs, while increasing global competition decreased corporations' ability to increase prices (Harrison and Bluestone, 1990). Corporations, especially those in manufacturing, introduced a variety of cost-cutting strategies to improve profitability. These strategies included automation, the relocation of production to low-wage areas within the United States and abroad, flexibility such as subcontracting, substituting part-time and temporary labor for fulltime labor, demanding concessions from their workforce, and finally abandoning core businesses such as steel, in favor of newer enterprises and more speculative ventures (Kutscher and Personick, 1986; Harrison and Bluestone, 1990; Moriarty, 1991). Many of these strategies reduced the bargaining and political power of unions, increased work fragmentation and underemployment, and reestablished a dual labor market, whereby two workers could be paid vastly different wages for the same job. New employees in the auto parts industry, for example, could be paid 45% less than the former base wage (Harrison and Bluestone, 1990). As a result, real hourly wage rates declined for every industrial sector except mining (Harrison and Bluestone, 1990).

Although wage rates dropped for every industrial sector, wage disparity increased within sectors (Harrison

and Bluestone, 1990; Levy and Murnane, 1992). In the financial sector, white-collar professionals received higher wages than semi-skilled and unskilled workers (Harrison and Bluestone, 1990). In manufacturing, semiskilled jobs declined faster than total manufacturing employment, reducing the demand and therefore the wages of individuals with lower education levels (Levy and Murnane, 1992). Average wages in industries such as producer services and high-tech manufacturing increased, while average wages in industries such as consumer services and retail trade decreased (Grubb and Wilson, 1992). Wages increased sharply for college graduates relative to high school graduates, and the wage differential between high school graduates and dropouts also increased. These factors increased inequality not only between, but also within age, race, and sex groups (Harrison and Bluestone, 1990; Bound and Johnson, 1992; Grubb and Wilson, 1992; Levy and Murnane, 1992). Since wages are the principal income component for most of the population, these changes in wages were a key factor in the recent rise in income and consumption inequality (Harrison and Bluestone, 1990; Cutler and Katz, 1992).

It has been suggested that the dramatic increase in the size of the workforce due to the large number of baby-boomers, women, and minorities entering the work force has contributed to the decrease in wages (Harrison and Bluestone, 1990; Levy and Murnane, 1992). While demographic changes are a factor, the increase in the size of the

workforce was offset by a large increase in jobs (Harrison and Bluestone, 1992). Unfortunately, the majority of jobs created were low wage service jobs. It was the proliferation of these types of jobs coupled with a decrease in high wage manufacturing jobs that contributed most to increasing inequality (Harrison and Bluestone, 1990; Levy and Murnane, 1992; Ray, 1992). If the majority of jobs created had been higher wage jobs, the increase in inequality may not have occurred. Job creation alone is not enough; the quality of jobs created is also important. (Harrison and Bluestone, 1990; Ray, 1992).

In Michigan, much of the attention has been focused on Detroit, Flint and the auto industry, which have and continue to experience serious employment losses. Other places and industries in Michigan, however, have also suffered from employment losses. Between 1980 and 1986 double digit unemployment occurred in metropolitan and nonmetropolitan counties (Redman and Rowley, 1989). Unemployment was higher in nonmetropolitan counties and the income gap between metropolitan and nonmetropolitan areas increased. Earnings per worker, which includes wages and net proprietor income, decreased by 8% for metropolitan counties, and 12% for nonmetropolitan counties between 1979 and 1986 (Redman and Rowley, 1989; Deavers, 1991).

1.2 Gaps in the Literature

Much of the literature regarding economic transformation in the United States has examined the structural changes and their impacts at a regional level (Jones and Kodras, 1990; Markusen and Carlson, 1989; O'hUallachain, 1985) and/or focused on metropolitan regions (Goe, 1990; Esparza, 1990; Kellerman, 1985; Mead, 1991; Noyelle and Stanback, 1983; Wheeler, 1990). This regional and metropolitan emphasis can be attributed to the fact that the majority of the U.S. population now lives in metropolitan areas. The statistical data base for Metropolitan Statistical Areas (MSAs) and census regions is also much larger than that available for individual nonmetropolitan counties, increasing the opportunity for more detailed studies of these regions.

Literature on nonmetropolitan restructuring has stressed that the nonmetropolitan economy has been structurally transformed to a diverse heterogeneous economy, which is no longer dependent upon agriculture (Bonnen, 1990; Castle, 1987; Henry, Drabenstott, and Gibson, 1988; Swanson, 1989; Hady and Ross, 1990; Marsden, Lowe and Whatmore, 1990; McNamara and Gunter, Rainey, 1976; Summers, Horton and Gringeri, 1990). Nevertheless, much of the literature continues to focus on the agricultural industry (Bonnen, Nelson, and Deavers, 1988; Commins, 1990; FitzSimmons, 1986; Susman, 1989).

The dominance of agricultural studies can be attributed to several factors. Historically, agriculture dominated the social and ideological structure of nonmetropolitan U.S., the present day heterogeneity of nonmetropolitan counties has slowed the development of social and political institutions outside of agriculture, agriculture still dominates the physical landscape, and some authors such as Crown (1991) have continued to use the terms interchangeably. All of these factors coupled with agrarian fundamentalism contribute to the perception that the nonmetropolitan United States continues to be an agrarian based economy (Swanson, 1989; Bonnen, 1990).

While some nonagricultural studies have been done on nonmetropolitan communities (Roepke and Freudenberg, 1981; Aiken, 1990; Glickman and Glasmeier, 1989; Glasmeier and Borchard, 1989; Glasmeier and Glickman, 1990; Glasmeier and Kays-Teran, 1989; Amos, 1988; Barancik, 1990; Esparza, 1990; Smith, 1990), significant gaps still exist in the literature concerning the impact of economic restructuring in nonmetropolitan areas. The differential impact of industrial transformation on metropolitan and nonmetropolitan counties has not been fully examined. A clear understanding of the present economic structure in most nonmetropolitan counties is also lacking. Many authors (Henry, Drabenstott, and Gibson, 1988; Lapping, Daniels, and Keller, 1989; Bonnen, 1990; Hady and Ross, 1990; Marsden, Lowe, and Whatmore, 1990) have stated that nonmetropolitan

America has evolved into a diverse, heterogeneous economy, which cannot be analyzed in aggregate, but Hady and Ross (1990) are among the few authors who have attempted to describe the economic structure present in all nonmetropolitan counties in the United States. Their model, which classified counties based on the percentage of labor and proprietor income generated by selected industries, was static, and left many counties unclassified. Some authors (Smith, 1990; Fik, Amey, and Malecki, 1991) have examined the impact of certain industries on nonmetropolitan counties within a particular state, but the body of literature is not large enough to provide a comprehensive picture of the impact of industrial transformation on nonmetropolitan regions. Social and economic data for nonmetropolitan areas is extremely limited (Swanson, 1989); and as a result, little attention has been paid to the economic and social well being of nonmetropolitan residents (Flora, 1990).

1.3 Purpose

This study examines trends in industrial transformation in Michigan's metropolitan and nonmetropolitan counties between 1978 and 1987. The spatially and temporally varying associations between industrial specialization and the level of real per capita income in metropolitan and nonmetropolitan counties in Michigan will also be analyzed. The spatial analysis examines the varying association between industrial specialization and the level of real per

capita income between metropolitan and nonmetropolitan counties. The temporal analysis examines the varying association between industrial specialization and the level of real per capita income over time. The three major industrial sectors considered are manufacturing; wholesale and retail trade; and finance, insurance and real estate (FIRE).

1.4 Data

In general, counties are differentiated as metropolitan, nonmetropolitan urban, and nonmetropolitan rural. In this study, nonmetropolitan urban and nonmetropolitan rural are combined and the analyses differentiates between metropolitan and nonmetropolitan counties However, in the descriptive analysis, nonmetropolitan counties are divided into nonmetropolitan urban and nonmetropolitan rural. Adjacent and nonadjacent counties which contain an urban population of 20,000 to 49,000 are considered nonmetropolitan urban, so are counties which contain an urban population of 2,500 to 19,999 and are adjacent to a metropolitan county. Nonadjacent counties with an urban population under 19,999 are classified as nonmetropolitan rural (Figure 1.1).

Variables representing economic conditions include: personal income and earnings by place of residence. Personal income was chosen as a measure of economic well-

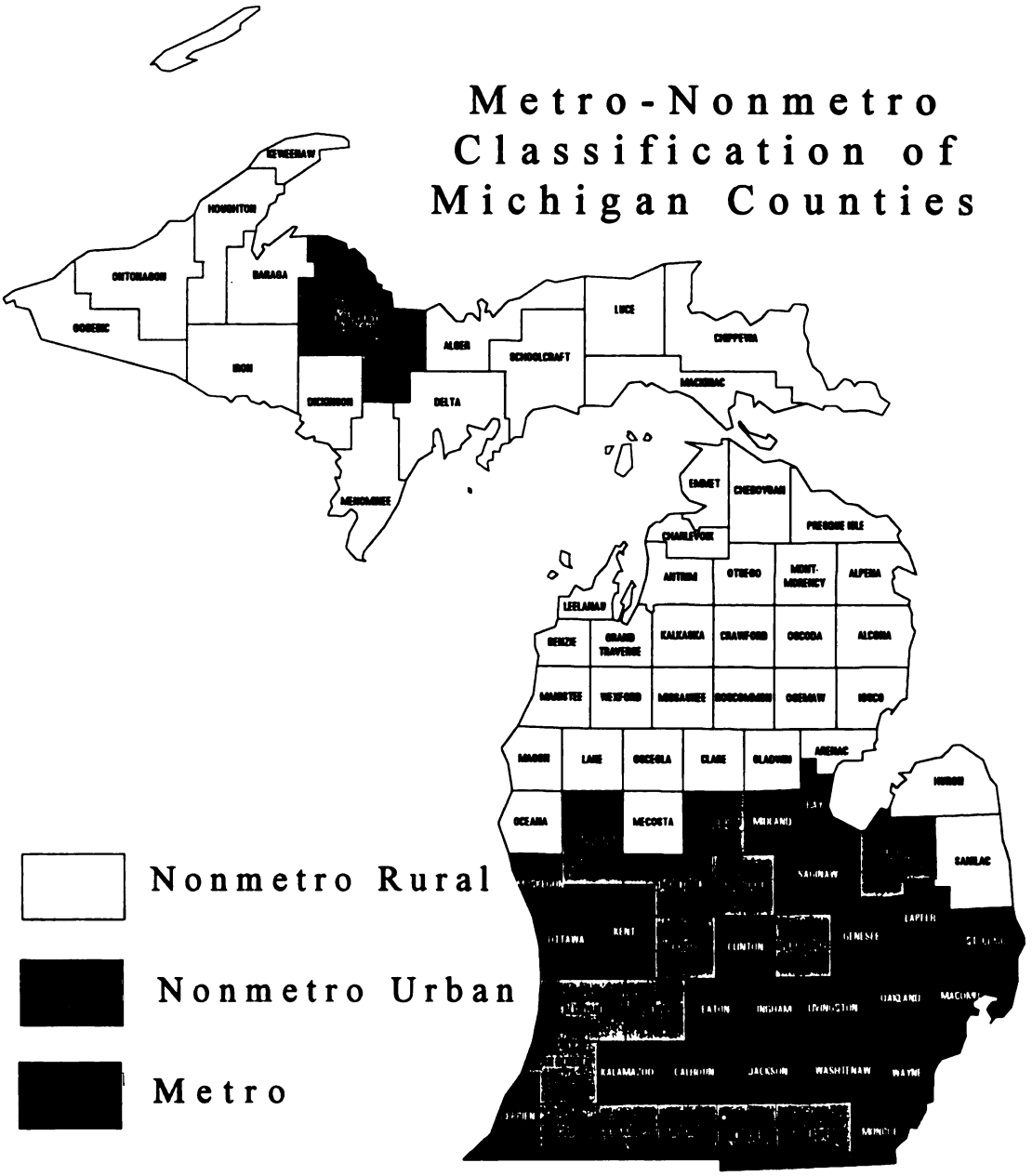

Figure 1.1. Metro-Nonmetro Classification of Michigan Counties

being, because it includes both employment and nonemployment income. It is derived from two sources: 1) earnings, which includes labor and proprietor income and 2) nonemployment income, which includes dividends, interest, and rent, and transfer payments. Although nonemployment income is increasing in Michigan, earnings still comprise the bulk of personal income (Bureau of Economic Analysis, 1981, 1990). Income data were obtained from the Bureau of Economic Analysis and U.S. Department of Commerce, (1981 and 1990). The consumer price index was used to adjust 1987 income and earnings to 1978 dollars, compensating for inflation between 1978 and 1987.

Industrial employment data are used to understand the patterning of job growth and job loss across industrial sectors. Changes in the number of establishments per industry category are used to examine business establishment expansion and contraction during the study period.

Variables selected to examine changes in industrial structure include the total number of employees and establishments in each county in the following categories in 1978 and 1987: agricultural, fishing, and forestry (AFF) services; mining; construction; manufacturing; transportation, communication and public utilities (TCPU); wholesale trade; retail trade; finance, insurance, and real estate (FIRE); and other services, which includes personal, health, recreation, hotel, and any services not included in the other service categories. Employment and establishment

data were obtained from County Business Patterns (U.S. Department of Commerce and Bureau of Census, 1980 and 1989), which provides annual information on the number of employees and number and size of establishments for each industrial category listed. County Business Patterns does not include government employment. It also does not distinguish between full-time and part-time employment.

CHAPTER TWO

LITERATURE REVIEW

Factors used to explain rising income inequality in the United States have included the characteristics of the dominant industries, level of industrial specialization, supply and demand shifts such as the size and age of the workforce, variations in education and skill, rising global competition, monetary policy, and the quantity and quality of jobs. Other explanations such as changes in the relative importance of location factors, technological changes, business cycles, variations in the export potential of regions, backwash and polarization effects, capital and labor flows, and product cycle stages have also been used (Walker and Storper, 1981; Lonsdale, 1982; Massey, 1984; Bradbury, 1985; Blackley, 1986; Booth, 1986; Amos, 1988; Kale, 1989; Harrison and Bluestone, 1990; Moriarty, 1991; Bound and Johnson, 1992; Grubb and Wilson, 1992; Levy and Murnane, 1992; Ray, 1992).

This study examines the association between industrial specialization and income levels. The following sections include a discussion of industrial shifts in the United States, and socio-economic impacts of industrial shifts.

2.1. Industrial Shifts in the United States

In the first half of the 20th Century the United States moved from an agrarian based economy to a manufacturing based economy. Between 1939 and 1953, the farm population declined by 35 percent as manufacturing industries in metropolitan areas in the North East and North Central regions expanded to meet the demands of the military, and then retooled in the post war years to fill consumer demand for durable goods (Cochrane, 1976; Deavers, 1991; Hatton and Williamson, 1992). In the late 1970s, these regions began declining as sectoral shifts from manufacturing to services took off (Markusen and Carlson, 1989; Moriarty, 1991). The highest manufacturing employment losses occurred in large, highly unionized cities (O'hUallachain, 1990), which had previously attracted rural migrants (Cochrane, 1976; Hatton and Williamson, 1992). The net gainers for manufacturing employment during this time period included regions formerly in decline and newly industrializing regions: parts of New England, the West North Central, Mountain, Pacific and the South (Markusen and Carlson, 1989).

These shifts in the location of production were accompanied by changes in the mode of production and changes in the relative importance of industrial location factors. Classic location models had predicted that producers would largely locate facilities at a point which minimizes the

cost of distance (Young, 1986; Kale, 1989). Technological changes in transportation and industrial production, however, have reduced the relative significance of distance as a location factor (Lonsdale, 1982; Young, 1986). Access to markets is still an important locational consideration (Fik, Amey, and Malecki, 1991; Patton and Markusen, 1991), but it is time and network linkages now, rather than actual distance, that determine transportation costs (Dubin, 1991; Drabenstott, 1991). Changes in the mode of production have resulted in a spatial reorganization of the production process, especially among large manufacturing firms. Large corporations have maintained their top-level management offices in large central cities (Wheeler, 1991; Ray, 1992), but moved middle management offices to the suburbs, and production units to more remote, low cost locations (Ray, 1992). Since the majority of manufacturing employment is in production, decentralization of production has led to manufacturing employment declines in larger cities, and manufacturing employment growth in smaller cities (O'hUallachain, 1990).

This does not mean that smaller cities have reaped all of the benefit at the expense of the larger urban centers. In the process of restructuring, a social and spatial division of labor has occurred. While the number of high wage, semiskilled jobs has declined in metropolitan counties, the number of professional and managerial jobs has increased. Manufacturing employment in metropolitan

counties has become more capital intensive, involving more high wage nonproduction related activities, while nonmetropolitan manufacturing activity has become more low wage production oriented (Blackley, 1986; Harrison and Bluestone, 1990; Deavers, 1991; Phillips and Miller, 1991; McGranahan, 1992).

In the service sector, the fastest growing sector in the 1980's has been producer services and retailing. Producer services have preferred metropolitan locations (Kirn, Conway, and Beyers, 1990; Wheeler, 1990), while retailing and other trade related industries such as wholesaling show relatively more dispersion to nonmetropolitan areas. As service and high-tech manufacturing industries began to increase in the United States, it was anticipated that these industries would encourage nonmetropolitan growth (Kirn, Conway, and Beyers, 1990). Many of these are often considered to be footloose industries. Factor price equalization and product cycle models predicted these industries would decentralize, and improvements in telecommunications gave nonmetropolitan areas better access to information and nonlocal markets (Kirn, Conway, and Beyers, 1990; Dillman, 1992). However, few nonmetropolitan counties have been able to attract high-tech manufacturing and higher order service industries, such as producer services. Nonmetropolitan counties which have been able to attract these industries are usually adjacent

to metropolitan counties, or in remote counties with large populations (Barkley and Keith, 1991).

Many nonmetropolitan counties have failed to attract high-tech manufacturing and higher order service industries, because they lack infrastructure such as constant voltage electricity and private telephone lines (Glasmeier and Borchard 1989; Glasmeier and Kays-Teran, 1989). Other counties which have the necessary infrastructure have not been able to attract these industries, because service industries have preferred to remain in metropolitan counties where they can access agglomeration economies, have greater opportunities for face to face contacts (Henry, Drabenstott, and Gibson, 1988; Goe, 1990; Deavers, 1991), and have ready access to a high skilled labor force (Kirn, Conway, and Beyers, 1990). Improvements in telecommunications have also allowed these companies to serve nonmetropolitan areas without relocating away from metropolitan regions (Kirn, Conway, and Beyers, 1990; Dillman, 1992) As a result, large metropolitan corporations can compete directly with small local businesses.

Producer services which do locate in nonmetropolitan counties are usually branch offices of multilocational organizations. These offices mainly perform back office functions such as data processing (Glasmeier and Kays-Teran, 1989). The wage rate for back office jobs is less than high order white collar jobs (Kirn, Conway, and Beyers, 1990). Their jobs are also less stable, as multilocational

companies can and do relocate facilities to other locations in search of lower labor costs (Kirn, Conway, and Beyers, 1990; Ray, 1992).

Multilocational firms in manufacturing and services also tend to bring their own managers and skilled workers with them. As a result, many of the jobs they create are low-wage jobs (Smith and Barkley, 1989; Kirn, Conway, and Beyers, 1990; Phillips and Miller, 1991; Ray, 1992). These companies tend to have network linkages established with suppliers outside of the local area, and therefore do not generate the same multiplier effect as a company which purchase parts and supplies locally (Glasmeier and Borchard, 1989; Kirn, Conway, and Beyers, 1990; Phillips and Miller, 1991). Locally owned producer services, in contrast, have strong links to the local economy and provide a higher proportion of high skill, high wage jobs (Kirn, Conway, and Beyers, 1990).

2.2 Socio-economic Consequences of Industrial Restructuring

As the United States shifts from a manufacturing based economy to a service based economy, metropolitan and nonmetropolitan counties are experiencing different changes and rates of growth in employment. While low wage consumer service jobs have increased in metropolitan and nonmetropolitan counties, growth in high wage producer

service jobs has occurred primarily in metropolitan counties. Metropolitan growth in these industries has also been faster. Between 1979 and 1987, nonmetropolitan employment for the nation increased 8%, while metropolitan employment increased by 20% (Mazie and Killian, 1991). In nonmetropolitan counties most of the employment growth came from consumer services (Deavers, 1991; Mazie and Killian, 1991). Jobs in this sector tend to be low-wage across occupational categories, and are often part-time (Mazie and Killian, 1991). Slow economic growth dominated by consumer service growth has resulted in higher unemployment and underemployment for individuals remaining in these counties.

Nonmetropolitan economic growth could be increased if more attention was directed toward non-traditional goods and services of nonmetropolitan areas for which demand may be growing (Castle, 1987). High amenity areas, for example, have been able to attract migrants and some industries, such as computer software firms and upscale food manufacturing and clothing marketers that other areas have not (Dillman, 1992). Tourism has also become more important to nonmetropolitan communities. While tourism can create jobs and provide additional income, most of the jobs it creates are low-wage and seasonal. Tourism also increases land-use conflicts in nonmetropolitan areas (Clark, 1992).

As a result of industrial shifts, nonmetropolitan counties and central city counties were left behind in the 1980s, because both areas lack the capital and human

resources necessary to promote development (Swanson, 1989). According to Mead (1991), metropolitan poverty results not from the lack of opportunities, but rather from the inability to take advantage of the opportunities present. Individuals below the poverty level in central city counties often lack the education and training necessary to find and maintain a well paying job (Wilson, 1987; Mead, 1991). Furthermore, adequate, affordable childcare is often not available for these individuals (Mead, 1991); and public transportation has not kept pace with firm decentralization, restricting the mobility of job-seeking individuals (Dubin, 1991). As a result, many of these individuals only have access to low wage jobs (Mead, 1991).

Nonmetropolitan poverty results from low wages, unemployment, underemployment, depression in the primary industries, and state welfare rules that exclude significant numbers of individuals poor by national standards (Molnar and Traxler, 1991). Structural reasons for nonmetropolitan poverty include several factors. Nonmetropolitan counties have a product mix which includes a significant proportion of unpriced public goods. Many counties are dependent on the extraction of raw materials, which are shipped through monopsonistic commodity markets to other locations for value added processing. Processing plants and distribution systems in nonmetropolitan counties are usually owned by entities located in metropolitan counties or other nations, who have no vested interest in the local community.

Significant transfer costs are imposed by economic, political, and physical distance from markets; and globally, industrial goods are being substituted for natural resources (Apedaile, 1991; Molnar and Traxler, 1991), decreasing the demand for traditional nonmetropolitan exports.

Nonmetropolitan poverty is also exacerbated by high levels of migration, because the better educated and trained individuals are the ones most likely to migrate (Tweeten and Brinkman, 1976; Molnar and Traxler, 1991; McGranahan, 1992), and the least likely to return (DaVanzo, 1983). Twenty-seven percent of individuals migrating out of nonmetropolitan areas in 1986-1987 had 4 years of college; and outmigrants were twice as likely to have a college degree than those left behind (Molnar and Traxler, 1991).

This loss of human capital reflects the fact that the more highly skilled jobs are disproportionally concentrated in metropolitan areas (Tweeten and Brinkman, 1976; Mazie and Killian, 1991; Molnar and Traxler, 1991), and metropolitan workers get paid more than nonmetropolitan workers for the same job (Mazie and Killian, 1991). This disparity increases with the education level and is increasing over time. By the end of the 1980s, college graduates in metropolitan areas were being paid 30% more for the same job as their nonmetropolitan counterparts (Deaver, 1991; McGranahan, 1992). The earnings gap for high school graduates was only 12% (Deavers, 1991).

This continued migration of educated, skilled workers to metropolitan areas decreases the human capital necessary for development, and increases the perception that nonmetropolitan workforces are composed primarily of low educated, unskilled workers. As a result, nonmetropolitan counties find it difficult to attract high tech manufacturing industries or high order service industries which could provide better paying jobs.

Since 1978, interstate and intrastate economic, social, and political inequality has increased within metropolitan areas and between metropolitan and nonmetropolitan areas (Edwards, 1976; Blackley, 1986; Alter and Long, 1988; Amos, 1988; Amos, 1989; Swanson, 1989; Aiken, 1990; Bonnen, 1990; Jones and Kodras, 1990; Summers, Horton, and Gingeri, 1990; Angel and Mitchell, 1991; Mead, 1991; Moriarty, 1991; McGranahan, 1992). In 1987 unemployment in nonmetropolitan areas in the U.S. was 31 percent higher than it was in metropolitan areas. Nonmetropolitan per capita income declined from 77 percent of metropolitan per capita income in 1979 to 73 percent of metropolitan per capita income in 1987 (Jones, 1988; Barancik, 1990). Nonmetropolitan incomes have not only lagged behind metropolitan incomes, but they have also been less stable over time (Henry, Drabenstott, and Gibson, 1988).

CHAPTER THREE

ECONOMIC TRANSFORMATION IN MICHIGAN

In Michigan, nonmetropolitan per capita income increased from 73% of metropolitan income in 1978 to 77% of metropolitan per capita income in 1987. Even though the gap narrowed, differences in income increased in Michigan during this time period (Table 3.1). While no significant difference existed between per capita income in metropolitan counties and nonmetropolitan counties in 1978, a significant difference did exist between per capita income in metropolitan counties and nonmetropolitan counties in 1987 (Table 3.1).

Table 3.1. Metro-Nonmetropolitan Variation in Per Capita Income, 1978 and 1987.

	Nonmetro	Metro	F'	Prob > F'
INC 1978	6055.31	8208.45	1.16	0.6384
INC 1987	7654.54	9970.31	2.91	0.0013

Real per capita income increased in all counties, except St. Clair between 1978 and 1987. However, not all counties experienced the same level of increase, thereby contributing to an increase in the difference in income between metropolitan and nonmetropolitan counties (Table 3.2).

Earnings comprise the bulk of personal income in Michigan, but the proportion of personal income derived from earnings is decreasing, especially in nonmetropolitan counties, where nonemployment income rose from 36.8% of

Table 3.2 Change in Real Per Capita Income by County, 1978-1987

	Inc Per Cap 1978	Real Inc Per Cap 1987	Change in Real Income Per Capita Abs.	Percent
Metropolitan Counties				
Bay	7,574	8,899	1,325	17.50
Berrien	7,596	8,897	1,301	17.13
Calhoun	8,254	8,801	547	6.62
Clinton	7,523	8,680	1,157	15.38
Eaton	7,843	9,450	1,607	20.49
Genesee	9,015	9,711	696	7.72
Ingham	8,593	10,060	1,467	17.08
Jackson	7,672	9,014	1,342	17.49
Kalamazoo	8,346	10,328	1,982	23.75
Kent	7,967	10,421	2,454	30.80
Lapeer	7,302	9,060	1,758	24.08
Livingston	7,497	11,326	3,829	51.08
Macomb	9,414	11,576	2,162	22.97
Midland	8,682	10,842	2,160	24.87
Monroe	7,748	9,386	1,638	21.14
Muskegon	6,920	8,319	1,399	20.21
Oakland	10,975	15,024	4,049	36.89
Ottawa	7,601	9,919	2,318	30.49
Saginaw	8,359	9,326	967	11.57
St Clair	7,218	7,182	-36	-0.50
Washtenaw	9,266	13,223	3,957	42.71
Wayne	9,221	9,903	682	7.39
Metro Ave	8,208	9,970	1,762	21.46
Nonmetropolitan Counties				
Alcona	5,118	7,152	2,034	39.73
Alger	4,883	6,590	1,707	34.96
Allegan	6,687	8,663	1,976	29.55
Alpena	6,498	7,754	1,256	19.33
Antrim	6,158	8,080	1,922	31.22
Arenac	5,921	7,226	1,305	22.05
Baraga	5,762	6,852	1,090	18.92
Barry	6,382	8,969	2,587	40.54
Benzie	6,351	7,802	1,451	22.85
Branch	7,428	7,731	303	4.09
Cass	7,479	8,869	1,390	18.59
Charlevoix	6,504	8,190	1,686	25.92
Cheboygan	5,785	7,257	1,472	25.44
Chippewa	5,110	6,703	1,593	31.17
Clare	5,303	6,474	1,171	22.08
Crawford	5,478	6,424	946	17.27
Delta	5,893	7,802	1,909	32.40
Dickinson	7,433	9,165	1,732	23.31
Emmet	6,966	9,416	2,450	35.17
Gladwin	5,461	6,635	1,174	21.50
Gogebic	5,949	7,124	1,175	19.75

Table 3.2 (cont'd)

Grand Traverse	8,048	9,801	1,753	21.78
Gratiot	7,152	8,017	865	12.10
Hillsdale	6,654	8,055	1,401	21.05
Houghton	5,516	6,948	1,432	25.96
Huron	6,902	9,288	2,386	34.57
Ionia	6,253	7,179	926	14.82
Iosco	5,615	7,290	1,675	29.83
Iron	5,775	7,508	1,733	30.00
Isabella	5,662	7,835	2,173	38.39
Kalkaska	4,766	6,384	1,618	33.96
Keweenaw	5,217	6,262	1,045	20.03
Lake	4,925	5,892	967	19.64
Leelanau	7,155	9,898	2,743	38.34
Lenawee	7,571	9,253	1,682	22.21
Luce	6,549	9,281	2,732	41.71
Mackinac	5,541	7,557	2,016	36.39
Manistee	6,347	7,782	1,435	22.61
Marquette	6,720	7,776	1,056	15.71
Mason	6,047	7,561	1,514	25.03
Mecosta	4,644	6,451	1,807	38.90
Menominee	5,903	7,218	1,315	22.28
Missaukee	4,859	6,402	1,543	31.76
Montcalm	6,348	7,635	1,287	20.27
Montmorency	5,509	7,012	1,503	27.28
Newaygo	5,790	7,393	1,603	27.68
Oceana	5,889	7,649	1,760	29.88
Ogemaw	4,820	6,496	1,676	34.76
Ontonagon	5,025	7,273	2,248	44.74
Osceola	5,084	6,306	1,222	24.04
Oscoda	4,108	6,364	2,256	54.91
Otsego	6,574	8,188	1,614	24.56
Presque Isle	5,511	6,995	1,484	26.92
Roscommon	5,262	7,197	1,935	36.78
Sanilac	6,279	9,556	3,277	52.19
Schoolcraft	5,578	8,712	3,134	56.18
Shiawassee	7,592	8,049	457	6.02
St Joseph	7,297	8,730	1,433	19.64
Tuscola	7,115	7,996	881	12.38
Van Buren	6,764	7,807	1,043	15.42
Wexford	6,459	7,053	594	9.20
Nonmetro Ave	6,055	7,655	1,599	26.41
Michigan	6,626	8,268	1,642	24.79

total personal income in 1978 to 46% in 1987 (Bureau of Economic Analysis, 1981, 1990).

Although earnings are becoming a smaller percentage of income, the correlation between income and earnings remains strong (Tables 3.3 and 3.4).

Table 3.3. Pearson Correlation Coefficients for Income and Earnings per Capita in Michigan, 1978.

	INCOME	EARNINGS
INCOME	1.000	0.966
EARNINGS	0.966	1.000

Table 3.4. Pearson Correlation Coefficients for Income and Earnings per Capita in Michigan, 1987.

	INCOME	EARNINGS
INCOME	1.000	0.918
EARNINGS	0.918	1.000

Even in nonmetropolitan counties, where the proportion of income derived from earnings is smaller than the state average, the correlation between income and earnings per capita is high (Tables 3.5 and 3.6).

Table 3.5. Pearson Correlation Coefficients for Income and Earnings per Capita in Nonmetropolitan Counties in Michigan, 1978.

	INCOME	EARNINGS
INCOME	1.000	0.918
EARNINGS	0.918	1.000

Table 3.6. Pearson Correlation Coefficients for Income and Earnings per Capita in Nonmetropolitan Counties in Michigan, 1987.

	INCOME	EARNINGS
INCOME	1.000	0.810
EARNINGS	0.810	1.000

The following sections examine changes in Michigan's industrial structure between 1978 and 1987. Percent distribution of employment and establishments is used to examine patterns of job growth, job loss, and business establishment expansion and contraction across industrial sectors. Entropy is used as a measure of industrial concentration/diversification; and location quotients are used to examine the level of employment specialization in manufacturing, wholesale and retail trade, and finance, insurance, and real estate.

Industrial Structure in Michigan

As the United States shifts from a manufacturing based economy to a service based economy, traditional manufacturing states such as Michigan are experiencing large declines in manufacturing output and employment. In spite of this decline, Michigan still remains more dependent on manufacturing than the country as a whole (Table 3.7). Michigan has experienced employment and establishment growth in the service sector, but its service sector in 1987 still comprised a smaller proportion of its employment and establishments than the national aggregate (Table 3.7).

Table 3.7. Percent Distribution of Employment and Estabishments for the United States and Michigan, 1978 and 1987.

Industrial Sector	EMPLOYMENT				ESTABLISHMENTS			
	United States		Michigan		United States		Michigan	
	1978	1987	1978	1987	1978	1987	1978	1987
AFF Services[1]	.4	.5	.2	.3	1.0	1.3	.9	1.2
Mining	1.2	.9	.4	.3	.7	.6	.3	.2
Construction	5.9	5.7	4.1	3.9	10.4	9.7	10.2	9.0
Manufacturing	29.5	22.3	40.1	31.1	7.6	6.4	9.4	8.3
TCPU[2]	6.2	6.0	5.0	4.5	3.9	4.0	3.1	3.3
Wholesale Trade	6.9	6.8	5.5	6.0	8.7	8.1	8.1	7.6
Retail Trade	20.7	21.6	19.9	21.6	29.2	26.3	29.9	27.7
FIRE[3]	7.0	7.9	5.2	5.8	9.7	9.3	8.6	7.6
Other Services[4]	22.3	28.3	19.7	26.5	28.8	34.3	29.6	35.1
Total[5]	100.1	100.0	100.1	100.0	100.0	100.0	100.1	100.0

1 AFF Services are Agricultural, Forestry and Fishing Services.
2 TCPU is Transportation, Communications, and Public Utilities.
3 FIRE is Finance, Insurance, and Real Estate.
4 Other Services includes personal, health, recreation, hotel, and any other service industries not included in the other service categories shown.
5 Totals may not add up to 100% due to rounding errors.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

Tables 3.8 and 3.9 show the percent distribution of employees and establishments in nine industrial sectors for different county types in 1978 and 1987. These tables indicate that the industrial structure for employment is considerably different than the industrial structure for establishments. The three largest employment categories for the state and all county types are manufacturing, retail trade and other services; while the three largest establishment categories are construction, retail trade and other services. This is due, in part, to differences in firm size, which varies across sectors. As a result, equal increases in the number of establishments in different sectors will generate different levels of employment. For example, construction firms, which on average employed 8 workers per establishment in 1978, comprised 10.2% of the establishments in Michigan, but only 4.1% of the total employment for that year, while manufacturing firms averaged 82 employees per establishment in 1978 and 62 employees per establishment in 1987. Manufacturing establishments comprised approximately 9% of the establishments for the state and each county type in 1978 and 8% in 1987, but accounted for approximately 40% of the total employment in 1978 and 30% of the total employment in 1987. Retail trade and other services combined accounted for approximately 60% of the establishments, but only 40% of the total employment. Establishments in the other services sector on average employed 13 persons per establishment in 1978 and 12 persons

Table 3.8. Percent Distribution of Employment by Industry Type, 1978 and 1987

Industrial Sector	County Type: Metropolitan 1978	Metropolitan 1987	All Nonmetro[1] 1978	All Nonmetro[1] 1987	Nonmetropolitan Rural 1978	Nonmetropolitan Rural 1987	Nonmetropolitan Urban 1978	Nonmetropolitan Urban 1987
AFF Services[2]	.2	.3	.3	.4	.3	.5	.2	.3
Mining	.1	.1	2.4	1.5	2.1	1.5	2.7	1.4
Construction	4.1	3.9	4.2	4.1	5.1	5.1	3.4	3.1
Manufacturing	40.3	31.0	38.7	32.4	34.3	28.0	43.2	36.7
TCPU[3]	5.1	4.6	3.9	4.0	4.9	4.7	2.9	3.3
Wholesale Trade	5.6	6.2	4.7	4.4	4.4	4.5	5.0	4.3
Retail Trade	19.3	21.0	23.8	25.6	25.4	27.2	22.1	24.0
FIRE[4]	5.3	5.9	4.3	4.6	4.6	4.8	3.9	4.4
Other Services[5]	20.0	27.0	17.8	23.1	18.9	23.7	16.6	22.5
Totals[6]	100.0	100.0	100.1	100.1	100.0	100.0	100.0	100.0

[1] Some data for nonmetropolitan counties in the United States is suppressed to comply with privacy laws. As a result, government data below the industrial sectors chosen is often not available for these counties. Also, if the number of firms in any one sector is limited, a range rather than the actual number of employees is given. In these instances I have substituted the midpoint of the range for the actual number of employees. That figure will be used in calculations throughout this thesis.

[2] AFF Services are Agricultural, Forestry and Fishing Services.

[3] TCPU is Transportation, Communications, and Public Utilities.

[4] FIRE is Finance, Insurance, and Real Estate.

[5] Other Services includes personal, health, recreation, hotel, and any other service industries not included in the other service categories shown.

[6] Totals may not add up to 100% due to rounding errors.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

Table 3.9. Percent Distribution of Establishments by Industry Type, 1978 and 1987

Industrial Sector	Metropolitan		All Nonmetro		Nonmetropolitan Rural		Nonmetropolitan Urban	
	1978	1987	1978	1987	1978	1987	1978	1987
AFF Services	.9	1.2	.9	1.2	.9	1.2	.9	1.2
Mining	.2	.1	.7	.6	.6	.6	.8	.6
Construction	9.7	8.7	11.6	10.1	12.6	11.0	10.6	9.2
Manufacturing	9.4	8.3	9.3	8.3	9.2	8.3	9.3	8.3
TCPU	2.9	3.1	3.7	4.0	4.1	4.3	3.3	3.7
Wholesale Trade	8.4	8.0	7.0	6.2	6.0	5.5	8.0	6.8
Retail Trade	28.7	26.6	34.7	31.6	34.8	32.0	34.6	31.1
FIRE	9.0	7.9	7.1	6.9	6.9	6.6	7.3	7.2
Other Services[1]	30.9	36.2	25.1	31.2	25.0	30.5	25.2	31.9
Totals[2]	99.0	100.1	100.1	100.1	100.1	100.0	100.0	100.0

[1] Other Services includes personal, health, recreation, hotel, and any other service industries not included in the other service categories shown.
[2] Totals may not add up to 100% due to rounding errors.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

per establishment in 1987. Retail establishments averaged 13 workers per establishment for both years.

A comparison of metropolitan and nonmetropolitan counties shows that while the majority of jobs for both county types were in the manufacturing sector for 1978 and 1987, manufacturing's share of employment is declining, particularly in metropolitan counties. In 1987, manufacturing employment comprised a larger percentage of the total employment in nonmetropolitan counties than it did in metropolitan counties. Manufacturing employment was particularly concentrated in the nonmetropolitan urban counties, where it comprised a larger percentage of the total employment than in metropolitan or nonmetropolitan rural counties for both years.

In metropolitan counties, the second largest employment category was "other services", which includes personal, health, recreation, hotel, and any other service not included in the other service categories listed in Tables 3.7-3.11. Employment in other services grew from 20% of metropolitan employment in 1978 to 27% in 1987. Retail trade was the second largest employment category in nonmetropolitan counties, especially in nonmetropolitan rural counties. In 1987, retail jobs comprised 27.2% of all nonmetropolitan rural jobs, just .8% less than the percentage of employment in the manufacturing sector for these counties.

Tables 3.10 and 3.11 show the change in employment and the number of establishments by industry between 1978 and 1987. Absolute change is used to show the change in the number of employees and establishments, and percentage change is used to show the relative importance of that change. Although the number of establishments increased in all sectors for all county types (Table 3.11), employment decreased in some sectors for some county types (Table 3.10).

Mining employment decreased in nonmetropolitan counties, while increasing in metropolitan counties. Construction employment increased in metropolitan and nonmetropolitan counties. Increased construction employment in nonmetropolitan counties occurred primarily in nonmetropolitan rural counties, nonmetropolitan urban counties saw a decrease in construction employment. Employment in transportation, communication, and public utilities decreased in metropolitan counties, but increased in nonmetropolitan counties. Manufacturing employment declined in metropolitan and nonmetropolitan counties, with the highest job losses occurring in metropolitan counties.

Within the manufacturing sector, the number of high tech establishments increased, while the number of employees decreased. High tech industries are industries which employ a higher percentage of engineers, engineering technicians, computer scientist, mathematicians, and life scientists than the national average, and apply science and engineering

Table 3.10. Change in Employment by County Type

Industrial Sector	Michigan		County Type: Metropolitan		All Nonmetro[1]		Nonmetropolitan: Urban		Nonmetropolitan: Rural	
	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng
AFF Services	4,708	79.37%	3,899	77.68%	809	88.57%	305	88.41%	504	88.73%
Mining	-3,120	-26.89%	21	0.87%	-3,141	-33.96%	-2,085	-44.42%	-1,056	-23.50%
Construction	5,163	4.31%	3,737	3.58%	1,426	6.97%	-193	-3.17%	1,619	17.11%
Manufacturing	-172,318	-14.73%	-166,059	-16.07%	-6,259	-4.44%	-4,239	-5.29%	-2,020	-3.59%
TCPU	-1,351	-0.93%	-3,880	-2.93%	2,529	19.13%	987	17.26%	1,542	20.99%
Wholesale Trade	30,288	18.87%	28,627	19.90%	1,661	10.09%	600	7.00%	1,061	13.18%
Retail Trade	112,964	17.75%	91,946	18.56%	21,018	24.70%	8,427	21.46%	12,591	27.94%
FIRE	32,425	21.35%	28,875	21.12%	3,550	23.41%	1,552	22.60%	1,998	24.21%
Other Services[2]	274,567	47.80%	242,914	47.51%	31,653	50.41%	15,599	53.73%	16,054	47.09%
Total Change	283,326		230,080		50,246		20,953		32,293	

[1] Much of the data for nonmetropolitan counties in the United States is suppressed to comply with privacy laws. If the number of firms in any one sector is limited, a range rather than the actual number of employees is given. In these instances I have substituted the midpoint of the range for the actual number of employees. That figure will be used in calculations throughout this thesis.
[2] Other Services includes personal, health, recreation, hotel, and any other service industries not included in the other service categories shown.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

Table 3.11. Change in Establishments by County Type

Industrial Sector	Michigan		County Type: Metropolitan		All Nonmetro		Nonmetropolitan Urban		Nonmetropolitan Rural	
	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng	Abs. Chng	% Chng
AFF Services	946	14.11%	743	40.73%	203	42.02%	73	39.67%	130	44.37%
Mining	68	14.20%	15	6.61%	53	17.51%	3	3.16%	50	31.85%
Construction	2,073	11.82%	1,699	12.55%	374	8.62%	87	6.08%	287	11.16%
Manufacturing	1,810	11.25%	1,430	11.09%	380	11.48%	121	8.81%	259	14.14%
TCPU	1,655	25.95%	1,223	25.48%	432	27.56%	166	28.33%	266	26.79%
Wholesale Trade	2,411	16.41%	2,145	17.39%	266	11.12%	94	8.62%	172	13.62%
Retail Trade	8,170	15.19%	6,419	15.54%	1,751	13.54%	554	11.04%	1,197	16.03%
FIRE	1,798	12.11%	1,288	10.59%	510	18.97%	219	18.90%	291	19.04%
Other Services[1]	23,142	33.89%	18,747	33.35%	4,395	36.42%	1,882	36.42%	2,513	36.42%
Total Change	42,073		33,709		8,364		3,199		5,165	

[1] Other Services includes personal, health, recreation, hotel, and any other service industries not included in the other service categories shown.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

principles in product and process development (Glasmeier and Kays-Teran, 1989; Smith and Barkley, 1991).

Metropolitan counties attracted the largest number of new high tech establishments during the study period. However, the largest percentage increase in high tech establishments occurred in the nonmetropolitan counties, particularly nonmetropolitan rural counties. Nonmetropolitan rural counties also suffered the lowest decrease in high tech employment. As a result, nonmetropolitan rural counties were the only county type in which high tech manufacturing employment increased as a percentage of total manufacturing employment (Tables 3.12 and 3.13).

Table 3.12. Changes in High Tech Employment and Number of High Tech Establishments in Michigan Between 1978 and 1987.

	EMPLOYMENT		ESTABLISHMENTS	
	Absolute Change	Percent Change	Absolute Change	Percent Change
Michigan	-124,651	-17.34	851	11.37
Metropolitan	-118,479	-18.25	637	9.72
Nonmetropolitan	-6,172	-7.33	214	24.23
Nonmetro Rural	-468	-1.84	134	33.25
Nonmetro Urban	-5,704	-12.82	80	15.21

Table 3.13. High Tech Manufacturing as a Percentage of All Manufacturing, 1978 and 1987.

	Percent High Tech Employment		Percent High Tech Establishments	
	1978	1987	1978	1987
Metropolitan	62.80	61.16	57.20	55.80
Nonmetropolitan	50.42	48.63	33.80	36.71
Nonmetro Rural	45.30	46.13	25.62	29.31
Nonmetro Urban	55.54	51.12	41.98	44.10

While both metropolitan and nonmetropolitan counties lost employment in high tech manufacturing between 1978 and 1987, the largest employment losses occurred in metropolitan counties, which lost employment in every SIC code used, except Instruments and Related Products (Table 3.14). Nonmetropolitan urban counties gained employment in the Chemical and Added Products, and Electrical and Electrical Equipment categories, but lost employment in Fabricated Metals, Machinery (except Electrical), Transportation Equipment, and Instruments and Related Product categories. Nonmetropolitan rural counties gained employment in Fabricated Metals, Electrical and Electrical Equipment, and Instruments and Related Products categories, but lost employment in Chemical and Added Product, Machinery (except Electrical), and Transportation Equipment categories.

The largest employment gains in Michigan occurred in the service sectors, especially in the retail and other services sectors. Nonmetropolitan counties experienced the largest percentage increase in both of these sectors. The largest percentage increase in retail employment occurred in nonmetropolitan rural counties, while the largest percentage increase in other services occurred in nonmetropolitan urban counties. The number of employees and establishments in the FIRE sector increased for both metropolitan and nonmetropolitan counties. The majority of employees and establishments in the FIRE sector are located in

Table 3.14 Employment Change in Selected SIC Categories

			County Type		
	Michigan	Metro[1]	All Nonmetro	Nonmetro Urban	Nonmetro Rural
Chemicals & Added Products	-12,115	-12,061	-54	321	-375
Fabricated Metals	-14,646	-14,525	-121	-2,278	2,157
Machinery, except electrical	-39,558	-34,256	-5,302	-3,585	-1,717
Electric & electronic equip	-710	-3,179	2,469	2,276	193
Transport equip	-60,285	-56,706	-3,579	-1,728	-1,851
Instruments & related products	2,663	2,248	415	-710	1,125

[1] Industrial data at this level is not always available for individual counties. If the number of firms in any one sector for any county is limited, a range rather than the actual number of employees is given. In these instances, I have substituted the midpoint of the range for the actual number of employees in that sector for that county.

Source: Calculated using data from U.S. Department of Commerce and Bureau of Census, 1980, 1987. County Business Patterns, Washington, D.C.: U.S. Government Printing Office.

metropolitan counties. These counties also saw the largest numerical increase in FIRE employment and establishments. The rate of increase was highest in the nonmetropolitan counties, especially the nonmetropolitan rural counties, which have a smaller number of employees and establishments in the FIRE sector.

In summary, between 1978 and 1987, the number of establishments increased in all county types, but this positive change in the number of establishments did not translate into a positive change in employment for all sectors in all county types. The highest job losses occurred in manufacturing, with metropolitan counties experiencing the highest losses. Service sector employment increased, but the service sector in Michigan is still smaller than the national aggregate. Most of Michigan's high tech manufacturing and FIRE employment was located in metropolitan counties, while retail trade employment comprised a larger percentage of nonmetropolitan employment.

3.2 Industrial Diversification

The nine employment categories shown in Tables 3.7-3.11 were used to calculate relative entropy as a measure of industrial diversification/concentration for each county for both years. Absolute entropy (H) is calculated as follows:

$$H = \sum_{i=1}^{n} p_i \ln p_i$$

where p_i is the proportion of establishments or employees in the ith industrial category, and ln denotes natural logarithms. Absolute entropy (H) is normalized as follows to facilitate comparison

$$R = (H/\ln k)100$$

where k is the number of industrial sectors. Relative entropy (R) measures the distribution of employees and establishments within the k industrial sectors. Its values range between 0 and 100. A relative entropy of 0 equals total concentration. A relative entropy of 100 implies that the employees and establishments are distributed equally between all sectors (Garrison and Paulson, 1973; Clarke, 1985; Wheeler, 1990). Concentration in a particular industry can give a region a comparative advantage, but income will be unstable as the region will be sensitive to short term economic shocks. Diversified economies are less sensitive to short term economic shocks and provide a more stable economic base (Henry, Dranbenstott and Gibson, 1988; Gilchrist and St. Louis, 1991).

Employment entropy for the state increased, implying that employment is becoming more evenly distributed between industrial sectors (Table 3.15). Establishment entropy decreased in Michigan between 1978 and 1987 for all county types, resulting in an industrial structure which was slightly more concentrated in 1987 than in 1978.

Table 3.15. Change in Relative Entropy

	EMPLOYMENT			ESTABLISHMENT		
	1978	1987	CHNG	1978	1987	CHNG
Michigan	74.77	76.44	2.00	79.87	78.16	-1.71
Metropolitan	73.96	76.21	2.25	79.67	77.76	-1.91
Nonmetropolitan	75.25	75.95	0.70	79.79	78.92	-0.87
Nonmetro Rural	77.66	78.33	0.67	79.55	79.03	-0.52
Nonmetro Urban	72.83	73.56	0.73	80.02	78.81	-1.21

Table 3.15 indicates that the majority of change in employment and establishment entropy occurred in the metropolitan counties. Absolute change in relative entropy for individual counties within each county type shows that the change in employment entropy for metropolitan counties ranged from -3.14 to 5.38. The majority of these counties experienced an increase in employment diversity (Appendix A). Entropy values for nonmetropolitan county varied considerably, as did the direction and magnitude of change in entropy values. Absolute change in employment entropy in nonmetropolitan urban counties ranged between -3.13 to 7.48, while absolute change in employment entropy for nonmetropolitan rural counties ranged from -9.59 to 15.22 (Appendix A).

Absolute change in relative entropy for individual counties showed that establishment diversity decreased between 1978 and 1987 in all metropolitan counties, except St Clair. While establishment diversity also decreased for most nonmetropolitan counties, some nonmetropolitan counties, such as Missaukee, experienced large increases in

establishment entropy. Absolute change in establishment entropy for metropolitan counties ranged from -7.70 to 0.24. Absolute change in establishment entropy ranged from -4.06 to 1.71 for nonmetropolitan urban counties, and -10.15 to 8.41 for nonmetropolitan rural counties (Appendix B).

The previous section demonstrated that Michigan is experiencing a sectoral shift from manufacturing to services. Changes in employment entropy indicate that employment is becoming more evenly distributed between industrial sectors. While changes in metropolitan entropy values were fairly homegeneous across counties, large variations existed in the direction and magnitude of changes in nonmetropolitan entropy values. However, Spearman correlation coefficients between relative entropies in 1978 and 1987 were 0.829 for establishment entropies and 0.825 for employment entropies, indicating a high similarity in industrial structure for both years.

3.3 Employment Specialization

Industrial specialization in Michigan counties was evaluated using location quotients. Since the major focus of this study is the shift from manufacturing to service industries, location quotients were only calculated for the following industrial sectors: manufacturing, wholesale and retail trade, and FIRE for 1978 and 1987. Wholesale and retail trade were selected as a proxy for lower order services, and FIRE was selected as a proxy for higher order

services. The location quotient for a county is determined by:

$$LQ = (X_i/Y_i)/(X_j/Y_j)$$

where X_i is the number of individuals employed in an industry in a county, Y_i is the total number of employees in a county, X_j is the number of individuals employed in an industry in the state of Michigan, and Y_j is the total number of employees in the state. A location quotient greater than one implies that a county is more specialized in, or has a higher level of employment in that sector than the state average. A location quotient less than one implies that a county has a lower level of employment in that sector than the state average (Isserman, 1977; Hammond and McCullagh; 1978).

An examination of the location quotients for these industrial sectors show that in 1978, 52 of the 83 counties in Michigan had a higher level of employment in wholesale and retail trade than the state average. That number increased to 54 in 1987 (Figure 3.1). The majority of these counties were nonmetropolitan. In 1978, 67.2% of all nonmetropolitan counties had higher levels of employment in wholesale and retail trade than the state average (Table 3.16). That percentage increased to 73.8% in 1987. Fifty percent of the metropolitan counties had higher levels of employment in wholesale and retail trade than the state average in 1978, but that share dropped to only 40.9% in 1987 (Tables 3.16 and 3.17).

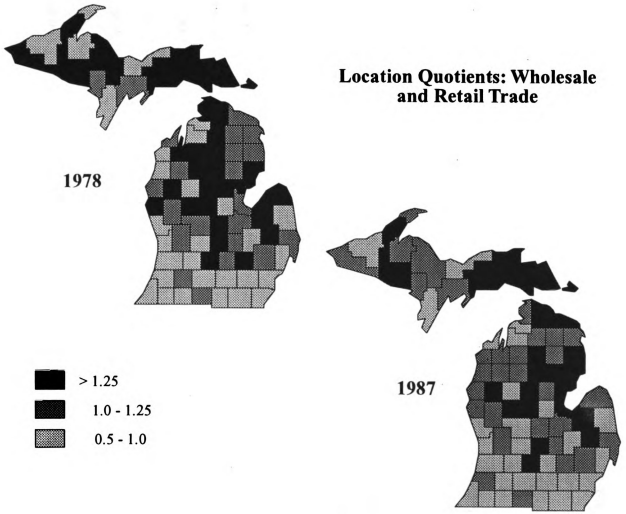

Figure 3.1. Location Quotients: Wholesale and Retail Trade

Thirty-six counties had a higher level of employment in manufacturing than the state average in 1978; and 37 counties did in 1987 (Figure 3.2). These counties were predominantly metropolitan or adjacent nonmetropolitan urban counties. Half of all metropolitan counties had higher than state average levels of employment in manufacturing for both years. Forty-one percent of all nonmetropolitan counties had higher than state average levels of employment in manufacturing in 1978, and 42.6% did in 1987. So although metropolitan counties suffered higher job losses in manufacturing than nonmetropolitan counties, manufacturing was still more concentrated in and around metropolitan counties. Nineteen counties in the state had a higher level of employment in FIRE than the state average for both years (Figure 3.3). 36.4% of all metropolitan counties had location quotients for FIRE greater than one in 1978; that share dropped to 31.8% in 1987 (Tables 3.16 and 3.17). Few nonmetropolitan counties had higher levels of employment in FIRE than state average. Nonmetropolitan counties with higher than state average employment in FIRE tended to be regional centers remote from metropolitan counties and amenity counties with real estate development potential.

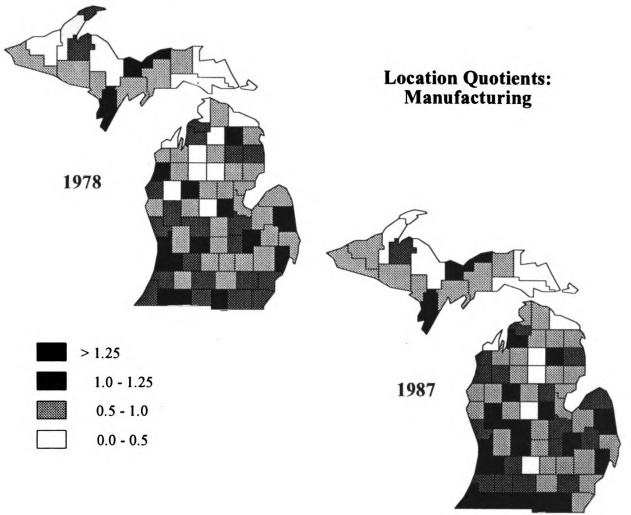

Figure 3.2. Location Quotients: Manufacturing

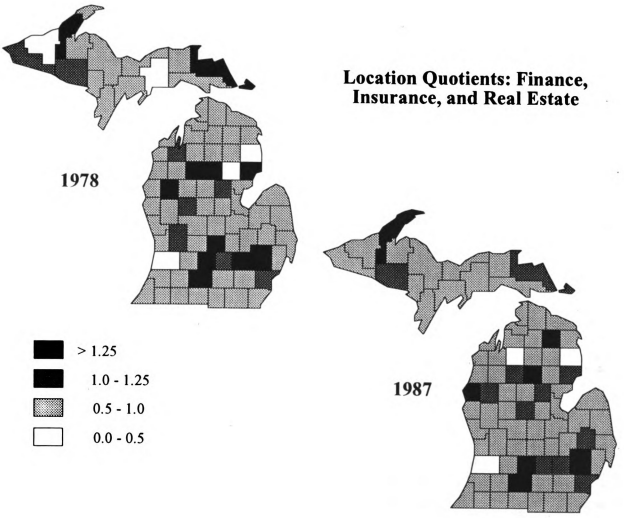

Figure 3.3. Location Quotients: Finance, Insurance, and Real Estate

Table 3.16. Geographic Distribution of Counties with Location Quotients Greater than One in 1978.

County Type	Trade No.	Trade %	Manufacturing No.	Manufacturing %	FIRE No.	FIRE %
Metropolitan	11	50.0	11	50.0	4	36.4
Nonmetropolitan	41	67.2	25	41.0	11	18.0
Nonmetro Rural	34	75.6	13	28.9	11	24.4
Nonmetro Urban	7	43.8	12	75.0	0	0.0

Table 3.17. Geographic Distribution of Counties with Location Quotients Greater than One in 1987.

County Type	Trade No.	Trade %	Manufacturing No.	Manufacturing %	FIRE No.	FIRE %
Metropolitan	9	40.9	11	50.0	7	31.8
Nonmetropolitan	45	73.8	26	42.6	12	19.7
Nonmetro Rural	37	82.2	14	31.1	11	24.4
Nonmetro Urban	8	50.0	12	75.0	1	0.1

While some change occurred in the location quotient for individual counties (Appendix C), an examination of the change in average location quotients per county type shows that little change occurred in the relative specialization of employment within Michigan between 1978 and 1987 (Table 3.18).

Table 3.18. Change in Average Location Quotients

County Type	LQMF[1] 1978	LQMF 1987	Change in LQMF
Michigan	0.92110	0.96305	0.04195
Metropolitan Co.	1.01257	1.06875	0.05618
Nonmetropolitan	0.95599	1.01037	0.05438
Nonmetro Rural	0.81322	0.83066	0.01744
Nonmetro Urban	1.09876	1.19008	0.09132

County Type	LQTR[1] 1978	LQTR 1987	Change in LQTR
Michigan	1.15216	1.12192	-0.03024
Metropolitan Co.	1.03963	1.03886	0.00078
Nonmetropolitan	1.15084	1.11437	-0.03647
Nonmetro Rural	1.23898	1.19326	-0.04572
Nonmetro Urban	1.06269	1.03547	-0.02722

County Type	LQFI[1] 1978	LQFI 1987	Change in LQFI
Michigan	0.90630	0.86297	-0.04333
Metropolitan Co.	1.00377	0.94646	-0.05731
Nonmetropolitan	0.83298	0.80280	-0.03018
Nonmetro Rural	0.91327	0.86603	-0.04724
Nonmetro Urban	0.75269	0.73956	-0.01312

[1] LQMF is the location quotient for manufacturing employment. LQTR is the location quotient for wholesale and retail trade employment. LQFI is the location quotient for FIRE.

On average, counties were slightly more specialized in manufacturing in 1987 than in 1978, with the largest change occurring in nonmetropolitan urban counties (Table 3.18). Metropolitan counties were the only county type to experience a positive change in average location quotients for wholesale and retail trade. As the figures in Table 3.18 indicate, this change was slight. Nonmetropolitan counties on average became relatively less specialized in

wholesale and retail trade in 1987 than they were in 1978. All county types on average became less specialized in FIRE in 1987 than they were in 1978.

T-tests indicate that a significant difference existed in the location of counties specializing in FIRE employment for both years (Table 3.19). A significant difference existed between metropolitan and nonmetropolitan counties in specialized manufacturing employment in 1978, but not in 1987 (Table 3.19). No significant difference existed in wholesale and retail trade employment specialization between metropolitan and nonmetropolitan counties for either year.

Table 3.19. Metropolitan Nonmetropolitan Variation in Employment Specialization, 1978 and 1987.

1978

	Nonmetro	Metro	F'	Prob > F'
LQMF	0.888	1.012	2.63	0.0164
LQTR	1.192	1.039	1.89	0.1070
LQFI	0.871	1.003	2.35	0.0105

1987

	Nonmetro	Metro	F'	Prob > F'
LQMF	0.924	1.068	1.47	0.327
LQTR	1.152	1.039	1.38	0.417
LQFI	0.833	0.947	2.23	0.016

3.4 Summary

Between 1978 and 1987, per capita income increased in all Michigan counties, except St. Clair. This increase in income was accompanied by an increase in metropolitan-nonmetropolitan variations in per capita income.

Although the number of establishments increased in all industrial sectors during this time period, employment in some sectors decreased. Technical changes have reduced the number of workers needed in some sectors (Harrison and Blustone, 1990); and many of the new establishments were smaller, employing fewer workers than older establishments, which were relocating and/or downsizing. So even though counties were able to attract new businesses, many of them still lost jobs.

The highest job losses occurred in manufacturing, with metropolitan counties experiencing the highest losses. Service sector employment increased, but the service sector in Michigan was still smaller than the national aggregate in 1987. Most of Michigan's high tech manufacturing and FIRE employment was located in metropolitan counties, while retail trade employment comprised a larger percentage of nonmetropolitan employment.

Employment diversity increased in Michigan during the study period. While changes in metropolitan entropy values were fairly homegeneous across counties, large variations existed in the direction and magnitude of changes in nonmetropolitan entropy values. Although the industrial structure in Michigan is changing, a high similarity existed between the industrial structure present in 1978 and the industrial structure present in 1987.

Significant metropolitan nonmetropolitan differences exists in the location of counties specialized in

manufacturing and FIRE employment. Counties specialized in manufacturing and FIRE employment are predominately metropolitan. Although a higher percentage of nonmetropolitan counties are specialized in wholesale and retail trade employment than metropolitan counties, no significant difference exists in the location of counties specialized in wholesale and retail trade.

CHAPTER FOUR

ANALYSES

Although Michigan is experiencing a sectoral shift from manufacturing to services, manufacturing continues to be an important employment sector. Significant metropolitan-nonmetropolitan variation exists in employment specialization in manufacturing and FIRE industries. No significant difference existed betweeen metropolitan and nonmetropolitan income per capita in 1978, but a significant difference did exist in 1987.

Regression analysis is used to examine the association between manufacturing and service employment specialization and income per capita in Michigan counties for 1978 and 1987. The initial model is specified as follows:

$$INC = b_0 + b_1LQMF + b_2LQTR + b_3LQFI + e \qquad (1)$$

where INC is income per capita, LQMF is the location quotient for manufacturing employment, LQTR is the location quotient for wholesale and retail trade employment, LQFI is the location quotient for FIRE employment, b_0, b_1, and b_3 are the regression coefficients, and e is the error term. First, metropolitan-nonmetropolitan variation in the above association is examined for 1978 and 1987. Second, temporal variation in the above association is examined. Stepwise regression procedure is used to obtain the most parsimonious spatial and temporal models.

The correlation matrix for the regression variables show that the location quotient for wholesale and retail trade employment (LQTR) is the only variable inversely correlated with income per capita (INC) for both years (Table 4.1 and 4.2). The location quotients for employment in FIRE (LQFI) and manufacturing (LQMF) are positively correlated with income per capita for both years. The location quotients for wholesale and retail trade and FIRE employment are inversely correlated with the location quotient for manufacturing employment.

Table 4.1. Pearson Correlation Matrix for 1978 Equations.

	INC	LQMF	LQTR	LQFI
INC	1.000	0.193	-0.355	0.037
LQMF	0.193	1.000	-0.687	-0.427
LQTR	-0.355	-0.687	1.000	0.535
LQFI	0.037	-0.427	0.535	1.000

Table 4.2. Pearson Correlation Matrix for 1987 Equations.

	INC	LQMF	LQTR	LQFI
INC	1.000	0.188	-0.307	0.066
LQMF	0.188	1.000	-0.702	-0.474
LQTR	-0.307	-0.702	1.000	0.434
LQFI	0.066	-0.474	0.434	1.000

4.1 Spatial Variation

The metropolitan-nonmetropolitan variation in the association between levels of specialization in manufacturing and service employment and income per capita

(see Equation 1) is examined using a dummy variable and the interaction between the dummy variable and the independent variables. The spatial model is specified as follows:

$$INC = b_{00} + b_{01}M + b_{10}LQMF + b_{11}M.LQMF + b_{20}LQTR + b_{21}M.LQTR + b_{30}LQFI + b_{31}M.LQFI + e \quad (2)$$

where M is the dummy variable; M is 0 for nonmetropolitan counties and M is 1 for metropolitan counties; M.LQMF, M.LQTR, and M.LQFI are interaction terms between the dummy variable and the independent variables described above; b_{00}, b_{01}, b_{10}, b_{11}, b_{20}, b_{21}, b_{30}, and b_{31} are the regression coefficients, and e is the error term. This model will be estimated using stepwise regression procedure to obtain a parsimonious model. If in the estimation process, any one of the coefficients associated with the interaction term is significant, then the model can be regarded as showing spatial variation.

4.2 Temporal Variation

Temporal variation in the association in Equation (1) is examined first by estimating Equation (1) for 1978 and 1987. Next, a model is developed to explain how the association between the levels of employment specialization and real income per capita changed over time. The model is specified as follows:

$$INC = b_{00} + b_{01}T + b_{10}LQMF + b_{11}T.LQMF + b_{20}LQTR + b_{21}T.LQTR + b_{30}LQFI + b_{31}T.LQFI + e \quad (3)$$

In this equation T is the dummy variable. T is 0 for 1978 and 1 for 1987; and T.LQMF, T.LQTR, and T.LQFI are interaction terms between the dummy variable and the independent variables. This model will also be estimated using stepwise regression procedure to obtain a parsimonious model. If in the estimation process, any one of the coefficients associated with the interaction term is significant, then the model can be regarded as showing temporal variation.

4.3 Results

If the regression coefficient associated with the location quotient for employment is significant and positive, then employment specialization in that sector is associated with higher levels of income per capita. If the regression coefficient associated with the location quotient for employment is significant and negative, then employment spcialization in that sector is associated with lower levels of income per capita.

Spatial Variation

The estimated results of equation (2) are as follows. The numbers in parenthesis are the t statistics.

1978 (4)

$$INC = 7174.843 - 933.740LQTR + 820.451M.LQFI + 1150.204M.LQMF$$
$$(15.33) \quad (-2.45) \quad (2.87) \quad (3.48)$$

$R^2 = .576$

1987 (5)

$$INC = 7654.541 + 4772.836M - 4069.010MLQTR + 1870.201MLQFI$$
$$(50.54) \quad (3.47) \quad (-2.43) \quad (2.14)$$

$R^2 = .464$

In 1978, specialization in wholesale and retail trade employment associated with lower levels of income per capita in general. Employment specialization in manufacturing and FIRE in metropolitan counties associated with higher levels of income per capita in 1978 (Table 4.3).

Table 4.3. Metro-Nonmetro Variation in the Association Between Employment Specialization and Income per Capita.

1978

	County Type	
Variable	Metropolitan	Nonmetropolitan
Intercept	7174.843	7174.843
LQMAN	1150.204	-
LQTRAD	-	-933.740
LQFIRE	1150.204	-

1987

	County Type	
Variable	Metropolitan	Nonmetropolitan
Intercept	12427.337	7654.541
LQTR	-4069.040	-
LQFI	1870.201	-

In 1987, employment specialization in wholesale and retail trade was negatively associated with income per capita in metropolitan counties, while employment specialization in the FIRE sector associated with higher levels of income per capita in these counties. No nonmetropolitan variables were selected in the stepwise regression procedure in 1987.

Temporal Variation

The estimated results of equation (1) are as follows. The numbers in parenthesis are the t statistics.

1978 (6)

$$INC = \underset{(8.09)}{8969.066} - \underset{(-.44)}{203.992LQMF} - \underset{(-3.79)}{2694.895LQTR} + \underset{(2.61)}{1047.995LQFI}$$

$R^2 = .200$

1987 (7)

$$INC = \underset{(6.12)}{9996.206} + \underset{(.20)}{119.236LQMF} - \underset{(-2.66)}{2644.316LQTR} + \underset{(2.10)}{1302.512LQFI}$$

$R2 = .143$

Specialization in wholesale and retail trade employment associated with low income per capita for both years. Specialization in FIRE employment, which is a high order service sector, associated with high income per capita. No clear association existed between specialization in

manufacturing employment and income per capita for 1978 or 1987.

However, the results from Equation (3) show that specialization in manufacturing employment in 1987 does help explain changes in income per capita over time.

$$\underset{}{INC} = \underset{(15.16)}{8604.055} - \underset{(-4.68)}{2305.956LQTR} + \underset{(2.10)}{786.112LQFI} + \underset{(3.11)}{1051.187T.LQFI}$$

$$+ \underset{(2.21)}{656.549T.LQMF} \qquad (8)$$

$R^2 = .362$

Specialization in manufacturing and FIRE employment associated positively with income per capita over time, while specialization in wholesale and retail trade employment associated negatively with income per capita over time.

Table 4.4. Temporal Variation in the Association Between Employment Specialization and Real Income per Capita.

Variables	Time 1 (1978)	Time 2 (1987)
Intercept	8604.055	8604.055
LQTR	-2305.956	-
LQFI	786.112	1837.299
LQMF	-	656.549

The regression analysis results indicate that spatial variation does exist in the association of employment specialization and income per capita between metropolitan and nonmetropolitan counties. Employment specialization in

wholesale and retail trade associated with lower per capita income in both county types in 1978, while employment specialization in manufacturing and FIRE associated with higher income per capita in metropolitan counties. In 1987 metropolitan counties specialized in wholesale and retail trade sector employment associated with lower levels of income per capita, while metropolitan counties specialized in finance, insurance, and real estate sector employment associated with higher levels of income per capita. No nonmetropolitan variables were selected in the stepwise regression procedure in 1987. This may be due to the higher levels of nonemployment income in nonmetropolitan counties for that year. The increase in the percentage of income derived from nonemployment decreased the correlation between income and earnings per capita to .810. While a correlation of .810 is still high, a regression model using earnings per capita as the dependent variable may have yielded different results.

The temporal analysis indicates that counties specializing in wholesale and retail trade employment will have lower income per capita, while counties specializing in manufacturing and FIRE employment will have higher income per capita. Specialization in manufacturing and FIRE employment was more important in explaining variations in income per capita in 1987 than in 1978.

CHAPTER FIVE

CONCLUSIONS

This study examined trends in industrial transformation in Michigan's metropolitan and nonmetropolitan counties between 1978 and 1987. Analyses of the spatially and temporally varying associations of sectoral employment specialization with income per capita provided an understanding of the metropolitan-nonmetropolitan variation in the effects of growth in the service sector.

Growth trends in employment and establishments indicate that Michigan is experiencing a sectoral shift from manufacturing to service industries. Although the number of manufacturing establishments grew in Michigan during the study period, the number of manufacturing employees decreased, indicating that new manufacturing establishments have not guaranteed a growth in Michigan's manufacturing employment. Many new manufacturing plants are smaller employing fewer workers than older establishments; and many older establishments are relocating and/or downsizing. In spite of this decline, manufacturing is still the largest employment sector in the state.

Service sector employment increased in all service categories in Michigan during the study period, thereby comprising a larger proportion of the workforce in 1987 than in 1978. The largest increases in service sector employment occurred in the retail and other services sectors. Other

services includes services such as personal, health, recreation, and hotel. However, since many service sector jobs are part-time and *County Business Patterns* does not distinguish between full-time and part-time employment, the contribution of service sector jobs to the total employment base may be overestimated.

Michigan's industrial structure varied between metropolitan and nonmetropolitan counties. Counties specializing in manufacturing employment in Michigan were predominantly metropolitan or adjacent nonmetropolitan urban counties, while counties specializing in wholesale and retail trade employment were more likely to be nonmetropolitan. Many manufacturing firms which decentralized production moved production facilities out of state, rather than to nonmetropolitan counties within the state. While nonmetropolitan counties were more likely to be specialized in wholesale and retail trade than metropolitan counties, no significant difference existed in the level of specialization in wholesale and retail trade between metropolitan and nonmetropolitan counties. Metropolitan counties were more likely to be specialized in finance, insurance, and real estate than nonmetropolitan counties. Significant metropolitan nonmetropolitan variation existed in the level of specialization in finance, insurance and real estate for both years.

Income per capita was higher in metropolitan counties than nonmetropolitan counties for both years, but this

difference was statistically significant only in 1987. Regression results showed that counties specializing in manufacturing and FIRE associated with higher income per capita, while counties specializing in wholesale and retail trade associated with lower income per capita. The regression analysis also indicated that spatial variation exists in the association of employment specialization and per capita income between metropolitan and nonmetropolitan counties. Employment specialization in wholesale and retail trade associated with lower income per capita in both county types in 1978, while employment specialization in manufacturing and FIRE associated with higher income per capita only in metropolitan counties. In 1987, metropolitan counties specializing in wholesale and retail trade sector employment associated with lower levels of income per capita, while metropolitan counties specializing in FIRE employment associated with higher levels of income per capita. No significant association existed between employment specialization and income per capita in nonmetropolitan counties in 1987. This may be due to higher levels of nonemployment income in nonmetropolitan counties for that year. In 1987, almost half of the per capita income in nonmetropolitan rural counties came from nonemployment income, compared to one third for nonmetropolitan urban counties, and 29% for metropolitan counties. This increased share in nonemployment income may

account for the diminished role of economic activities in contributing toward higher levels of per capita income.

Results suggest that growth in the number of wholesale and retail establishments in Michigan will increase the employment base. However, since these jobs are low-wage and often part-time, they are not likely to contribute significantly to per capita income growth. The results from the regression analysis confirm that counties specializing in wholesale and retail trade employment are associated with lower levels of income per capita relative to other counties in the state.

Counties specializing in manufacturing and FIRE, on the other hand, associated with relatively higher levels of income per capita. This suggests that increasing employment in these sectors would contribute to per capita income growth, particularly in the metropolitan counties. Michigan did experience an increase in the number of manufacturing establishments during the study period. However, this increase in the number of establishments did not prevent a decline in the number of manufacturing employees. The FIRE sector is a small, but growing portion of the Michigan workforce. The literature (Goe, 1990; Deavers, 1991; Mazie and Killian, 1991) and data suggest that metropolitan counties have a comparative advantage in attracting establishments in this sector. Twenty-four percent of nonmetropolitan rural counties also had higher levels of employment in FIRE than the state average, which suggests

that nonmetropolitan counties can attract employment in this sector also. However, nonmetropolitan counties are likely to attract branch offices, which perform low order service functions, and therefore do not generate the same level of income as may be expected for this sector. The regression results showed no significant association between employment specialization in FIRE and per capita income in nonmetropolitan counties.

Future research on the consequences of sectoral employment specialization can be conducted at the national scale including all U.S. metropolitan and nonmetropolitan counties. Furthermore, the service sector should be disaggregated to include low order and high order producer services, consumer services and government services. Spatially and temporally varying associations between sectoral specialization and income growth will provide an understanding of the much debated role of the service sector in economic growth and development.

APPENDICES

Appendix A. Change in Employment Entropy by County

	Relative Employment Entropy 1978	1987	Change in Entropy
Metropolitan Counties			
Bay	72.59334	75.86407	3.27
Berrien	68.45241	70.75941	2.31
Calhoun	69.72824	72.63964	2.91
Clinton	79.80365	80.49980	0.70
Eaton	79.24817	76.57311	-2.68
Genesee	65.11228	67.55609	2.44
Ingham	75.97192	78.07927	2.11
Jackson	74.66495	77.08547	2.42
Kalamazoo	72.06938	73.49707	1.43
Kent	76.22687	77.26620	1.04
Lapeer	74.97229	72.90789	-2.06
Livingston	76.42201	77.26264	0.84
Macomb	63.79807	69.18040	5.38
Midland	54.35638	60.68467	6.33
Monroe	72.10636	76.48230	4.38
Muskegon	72.30092	72.79702	0.50
Oakland	79.46150	78.85147	-0.61
Ottawa	66.35210	68.71649	2.36
Saginaw	70.24888	74.99119	4.74
St. Clair	82.08117	78.94162	-3.14
Washtenaw	70.83764	70.39898	-0.44
Wayne	73.24802	76.69096	3.44
Nonmetropolitan Urban Counties			
Allegan	60.92726	62.00719	1.08
Barry	65.50331	71.57562	6.07
Branch	66.30475	68.49940	2.19
Cass	59.23625	65.04807	5.81
Gratiot	76.51702	76.68765	0.17
Hillsdale	63.17194	66.26621	3.09
Ionia	61.17707	68.65535	7.48
Isabella	78.71965	76.26590	-2.45
Lenawee	64.18860	67.45609	3.27
Marquette	82.18158	79.04691	-3.13
Montcalm	63.70567	63.59099	-0.11
Newaygo	70.15641	71.19166	1.04
Shiawasse	66.10517	68.93561	2.83
St. Joseph	70.47244	72.82527	2.35
Tuscola	76.07662	75.58473	-0.49
Van Buren	68.58573	74.94815	6.36

Appendix A (cont'd)

Nonmetropolitan Rural Counties

Alcona	61.45122	65.09959	3.65
Alger	47.27074	62.49175	15.22
Alpena	74.82241	82.81649	7.99
Antrim	64.49357	72.35568	7.86
Arenac	72.68775	72.46211	-0.23
Baraga	65.31294	71.11793	5.80
Benzie	69.83168	72.54943	2.72
Charlevoix	67.67434	72.68956	5.02
Cheboygan	75.28262	73.95201	-1.33
Chippewa	79.51725	73.93579	-5.58
Clare	75.55737	72.06635	-3.49
Crawford	69.74454	64.42448	-5.32
Delta	73.35298	73.47217	0.12
Dickinson	85.99646	81.47088	-4.53
Emmet	75.55818	73.94023	-1.62
Gladwin	73.41076	71.67717	-1.73
Gogebic	73.66464	71.96065	-1.70
Grand Traverse	80.83282	81.74339	0.91
Houghton	78.46973	76.65636	-1.81
Huron	78.56284	75.20527	-3.36
Iosco	77.04513	77.13506	0.09
Iron	75.90978	73.43621	-2.47
Kalkaska	85.85982	82.50232	-3.36
Keweenaw	73.91803	74.42386	0.51
Lake	70.21590	75.01457	4.80
Leelanau	71.85560	70.77796	-1.08
Luce	74.21798	74.10111	-0.12
Mackinac	83.72862	76.81700	-6.91
Manistee	65.40521	74.44395	9.04
Mason	70.11648	75.74495	5.63
Mecosta	72.21117	71.74255	-0.47
Menominee	66.32979	72.91581	6.59
Missaukee	87.66909	78.07616	-9.59
Montmorency	56.61645	71.45575	14.84
Oceana	77.35609	77.81389	0.46
Ogemaw	70.51595	74.14078	3.62
Ontonagon	61.12360	75.60382	14.48
Osceola	58.54061	66.79627	8.26
Oscoda	61.30373	66.12240	4.82
Otsego	74.80658	77.89336	3.09
Presque Isle	76.05949	85.92864	9.87
Roscommon	66.67840	67.18048	0.50
Sanilac	74.88097	78.11347	3.23
Schoolcraft	58.03861	64.05317	6.01
Wexford	72.01909	72.10462	0.09

Appendix B. Change in Establishment Entropy by County

	Relative Establishment Entropy 1978	1987	Change in Entropy
Metropolitan Counties			
Bay	77.79659	76.24495	-1.55
Berrien	80.17967	78.35391	-1.83
Calhoun	77.79314	70.09778	-7.70
Clinton	82.08196	80.94462	-1.14
Eaton	78.45402	76.81712	-1.64
Genesee	73.74501	71.72137	-2.02
Ingham	76.37366	73.50626	-2.87
Jackson	80.90594	78.24403	-2.66
Kalamazoo	79.17145	77.26760	-1.90
Kent	82.24072	80.59554	-1.65
Lapeer	81.32722	81.01219	-0.32
Livingston	81.24935	79.77011	-1.48
Macomb	79.93557	79.02732	-0.91
Midland	75.43796	73.52879	-1.91
Monroe	79.77753	79.37415	-0.40
Muskegon	77.49029	76.08789	-1.40
Oakland	81.33286	78.29550	-3.04
Ottawa	82.66756	81.35823	-1.31
Saginaw	77.73565	75.45896	-2.28
St Clair	78.49533	78.73376	0.24
Washtenaw	76.29162	74.32557	-1.97
Wayne	77.54782	75.93052	-1.62
Nonmetropolitan Urban Counties			
Allegan	82.64651	78.62428	-4.02
Barry	78.32929	77.80953	-0.52
Branch	79.38360	79.60827	0.22
Cass	78.25665	79.96177	1.71
Gratiot	78.73256	78.09178	-0.64
Hillsdale	81.20747	81.52424	0.32
Ionia	77.48483	78.19139	0.71
Isabella	79.32846	77.63201	-1.70
Lenawee	77.91652	76.30655	-1.61
Marquette	75.66988	75.39663	-0.27
Montcalm	79.65458	78.79434	-0.86
Newaygo	79.13347	78.89573	-0.24
Shiawassee	82.59376	80.86793	-1.73
St Joseph	80.16015	76.10220	-4.06
Tuscola	79.77241	78.59219	-1.18
Van Buren	80.17234	79.37759	-0.79

Appendix B (cont'd)

Nonmetropolitan Rural Counties

Alcona	70.84133	73.43120	2.59
Alger	76.79557	77.02991	0.23
Alpena	80.65436	80.15906	-0.50
Antrim	78.44437	82.48892	4.04
Arenac	80.77228	79.39158	-1.38
Baraga	82.48341	78.72770	-3.76
Benzie	73.86695	76.75248	2.89
Charlevoix	79.26653	77.82703	-1.44
Cheboygan	74.87204	73.21088	-1.66
Chippewa	77.87930	73.98892	-3.89
Clare	76.15425	77.11653	0.96
Crawford	76.37662	66.22577	-10.15
Delta	78.06125	78.97835	0.92
Dickison	81.21837	79.07615	-2.14
Emmet	76.12357	76.12769	0.00
Gladwin	73.85649	76.83327	2.98
Gogebic	75.12160	74.54089	-0.58
Grand Traverse	79.83352	80.33562	0.50
Houghton	78.83567	75.59984	-3.24
Huron	81.61666	79.73494	-1.88
Iosco	76.42943	76.33898	-0.09
Iron	79.53795	77.50027	-2.04
Kalkaska	83.78438	87.43943	3.66
Keweenaw	67.71945	71.61369	3.89
Lake	75.17676	71.42951	-3.75
Leelanau	78.63193	77.18904	-1.44
Luce	78.88942	77.70478	-1.18
Mackinac	72.28150	71.77199	-0.51
Manistee	77.71028	77.39337	-0.32
Mason	77.07690	76.63218	-0.44
Mecosta	78.72645	77.06365	-1.66
Menominee	83.98276	83.14731	-0.84
Missaukee	81.45536	89.86670	8.41
Montmorency	78.32502	77.31272	-1.01
Oceana	77.54110	77.78664	0.25
Ogemaw	80.56881	80.55084	-0.02
Ontonagon	76.09141	74.44338	-1.65
Osceola	78.85545	79.82524	0.97
Oscoda	73.14889	75.13018	1.98
Otsego	81.18424	82.31628	1.13
Presque Isle	79.80154	80.74858	0.95
Roscommon	68.31536	73.26179	4.95
Sanilac	79.84426	79.42701	-0.42
Schoolcraft	78.27778	76.28132	-2.00
Wexford	81.23160	78.09029	-3.14

Appendix C. (a) Change in Location Quotients for Manufacturing by County

	LQMF 1978	LQMF 1987	Change In LQMF
Metropolitan Counties			
Bay	0.92498	0.82676	-0.09822
Berrien	1.16293	1.25187	0.08894
Calhoun	1.09249	1.02741	-0.06509
Clinton	0.73004	0.86469	0.13464
Eaton	0.60112	0.42904	-0.17207
Genesee	1.27051	1.53872	0.26821
Ingham	0.87154	0.86295	-0.00859
Jackson	0.77049	0.95065	0.18016
Kalamazoo	0.98335	1.03037	0.04702
Kent	0.89987	0.97054	0.07066
Lapeer	0.90797	1.11574	0.20777
Livingston	0.77020	0.86057	0.09037
Macomb	1.29663	1.34028	0.04365
Midland	1.82571	2.13742	0.31171
Monroe	1.00867	0.96801	-0.04066
Muskegon	1.08181	1.12378	0.04197
Oakland	0.69987	0.65356	-0.04630
Ottawa	1.28276	1.46898	0.18623
Saginaw	1.10531	1.03989	-0.06542
St. Clair	0.87764	0.97228	0.09464
Washtenaw	1.08646	1.13599	0.04953
Wayne	1.02630	0.94304	-0.08327
Nonmetropolitan Counties			
Alcona	1.09329	1.02803	-0.06526
Alger	2.29886	1.68975	-0.60911
Allegan	1.42069	1.62374	0.20304
Alpena	0.91356	0.85452	-0.05903
Antrim	1.19967	1.28494	0.08527
Arenac	0.85020	0.57741	-0.27279
Baraga	1.23084	1.19757	-0.03327
Barry	1.22039	1.24331	0.02292
Benzie	0.87646	1.02019	0.14373
Branch	1.24930	1.48593	0.23663
Cass	1.43758	1.59645	0.15887
Charlevoix	1.20745	1.21735	0.00990
Cheboygan	0.73299	0.60509	-0.12790
Chippewa	0.24305	0.42798	0.18494
Clare	0.72429	0.60296	-0.12133
Crawford	0.51014	0.32143	-0.18871
Delta	0.89785	0.95179	0.05394
Dickinson	0.70976	0.90726	0.19750
Emmet	0.44674	0.53029	0.08356
Gladwin	0.68416	1.02550	0.34134
Gogebic	0.62943	0.50841	-0.12102

Appendix C. (a) (cont'd)

Grand Traverse	0.53074	0.61765	0.08691
Gratiot	0.74715	0.70804	-0.03910
Hillsdale	1.38366	1.55902	0.17536
Houghton	0.32939	0.40120	0.07180
Huron	0.84526	1.17056	0.32531
Ionia	1.33622	1.40841	0.07219
Iosco	0.67342	0.63782	-0.03560
Iron	0.65913	0.55581	-0.10332
Isabella	0.37201	0.34831	-0.02370
Kalkaska	0.24820	0.92559	0.67738
Keweenaw	1.21459	0.47494	-0.73964
Lake	0.29279	0.60392	0.31113
Leelanau	0.33332	0.35077	0.01745
Lenawee	1.23999	1.33750	0.09751
Luce	0.60280	0.91325	0.31045
Mackinac	0.37997	0.21404	-0.16593
Manistee	1.31757	1.14301	-0.17456
Marquette	0.14745	0.16293	0.01548
Mason	1.04206	0.96666	-0.07540
Mecosta	0.79756	0.77696	-0.02060
Menominee	1.32335	1.39745	0.07409
Missaukee	0.44926	0.59525	0.14599
Montcalm	1.24829	1.54725	0.29896
Montmorency	1.41660	0.82856	-0.58803
Newaygo	1.11009	1.29684	0.18675
Oceana	0.69767	0.94114	0.24347
Ogemaw	0.98796	0.82096	-0.16700
Ontonagon	0.39790	0.52783	0.12993
Osceola	1.50406	1.60467	0.10061
Oscoda	1.23042	1.31664	0.08623
Otsego	0.48876	0.69252	0.20376
Presque Isle	0.19074	0.40090	0.21017
Roscommon	0.45789	0.35734	-0.10054
Sanilac	1.31064	1.46521	0.15457
Schoolcraft	0.65954	0.77398	0.11444
Shiawassee	1.09229	1.03635	-0.05595
St. Joseph	1.52435	1.65612	0.13177
Tuscola	0.91102	0.96730	0.05628
Van Buren	1.13967	1.06383	-0.07584
Wexford	0.96444	1.15446	0.19001

Appendix C. (b) Change in Location Quotients for Wholesale and Retail Trade by County

	LQTR 1978	LQTR 1987	Change in LQTR
Metropolitan Counties			
Bay	1.21652	1.25135	0.03483
Berrien	0.94524	0.89943	-0.04581
Calhoun	0.89032	0.97574	0.08541
Clinton	1.37951	1.30151	-0.07801
Eaton	1.51663	1.71129	0.19466
Genesee	0.94405	0.99164	0.04758
Ingham	1.09033	0.98983	-0.10050
Jackson	0.81776	0.98933	0.17158
Kalamazoo	1.05068	0.99064	-0.06004
Kent	1.11584	1.05660	-0.05924
Lapeer	1.26095	1.25712	-0.00384
Livingston	1.26999	1.05137	-0.21862
Macomb	0.91953	0.97562	0.05609
Midland	0.65960	0.66651	0.00692
Monroe	0.93022	0.95876	0.02854
Muskegon	0.89924	0.97590	0.07667
Oakland	1.16031	1.06152	-0.09880
Ottawa	0.89676	0.82466	-0.07209
Saginaw	1.02046	1.06939	0.04892
St. Clair	1.18665	1.05880	-0.12785
Washtenaw	0.80606	0.89871	0.09265
Wayne	0.89528	0.89918	0.00390
Nonmetropolitan Counties			
Alcona	1.20091	1.35332	0.15240
Alger	0.81580	0.64635	-0.16945
Allegan	0.77386	0.79614	0.02228
Alpena	1.24474	1.18933	-0.05541
Antrim	0.99054	0.86621	-0.12433
Arenac	1.35289	1.31678	-0.03611
Baraga	0.98110	1.03897	0.05787
Barry	0.91825	0.96095	0.04270
Benzie	0.96313	1.03589	0.07276
Branch	1.17659	1.00315	-0.17344
Cass	0.88609	0.85947	-0.02662
Charlevoix	0.78881	0.86847	0.07966
Cheboygan	1.35247	1.28452	-0.06796
Chippewa	1.57363	1.39805	-0.17557
Clare	1.31143	1.50194	0.19050
Crawford	1.35466	1.53375	0.17909
Delta	1.12076	1.21597	0.09522
Dickinson	1.19257	1.11337	-0.07920
Emmet	1.26790	1.16152	-0.10638
Gladwin	1.45767	1.23117	-0.22650
Gogebic	1.38852	1.21112	-0.17740

Appendix C. (b) (cont'd)

Grand Traverse	1.28662	1.09865	-0.18797
Gratiot	1.25817	1.18255	-0.07562
Hillsdale	0.88578	0.87468	-0.01110
Houghton	1.38243	1.31281	-0.06962
Huron	1.28309	1.10494	-0.17815
Ionia	0.94818	0.95573	0.00755
Iosco	1.46171	1.56620	0.10449
Iron	1.46858	1.47588	0.00730
Isabella	1.81294	1.39926	-0.41368
Kalkaska	1.31793	1.00261	-0.31532
Keweenaw	0.99129	1.00082	0.00954
Lake	1.82033	1.39554	-0.42479
Leelanau	1.03075	0.98471	-0.04604
Lenawee	0.98490	0.88229	-0.10262
Luce	1.79697	1.49470	-0.30227
Mackinac	1.45981	1.38272	-0.07709
Manistee	0.89370	1.13350	0.23979
Marquette	1.25096	1.24466	-0.00629
Mason	1.02253	1.03668	0.01415
Mecosta	1.49302	1.40480	-0.08821
Menominee	0.97077	0.88175	-0.08901
Missaukee	1.44451	1.10296	-0.34155
Montcalm	0.98485	0.82811	-0.15674
Montmorency	1.15479	1.21431	0.05952
Newaygo	1.04280	1.05158	0.00878
Oceana	1.39732	1.24152	-0.15580
Ogemaw	1.21882	1.40465	0.18583
Ontonagon	0.59304	0.78177	0.18873
Osceola	0.83885	0.95132	0.11247
Oscoda	1.19153	1.06342	-0.12811
Otsego	1.44389	1.19361	-0.25028
Presque Isle	1.16993	1.27181	0.10188
Roscommon	1.99992	2.02301	0.02309
Sanilac	0.97044	0.89243	-0.07801
Schoolcraft	1.26189	1.28181	0.01992
Shiawassee	1.06478	1.19274	0.12796
St. Joseph	0.73266	0.90439	0.17173
Tuscola	1.29217	1.28467	-0.00750
Van Buren	0.99005	1.14721	0.15716
Wexford	1.03214	1.03101	-0.00114

Appendix C. (c) Change in Location Quotients for FIRE by County

	LQFI 1978	LQFI 1987	Change In LQFI
Metropolitan Counties			
Bay	0.84212	0.83438	-0.00774
Berrien	0.77561	0.77235	-0.00326
Calhoun	1.57635	1.46651	-0.10983
Clinton	1.28099	0.79695	-0.48404
Eaton	2.80109	2.25746	-0.54363
Genesee	0.67850	0.60558	-0.07291
Ingham	1.18226	1.19083	0.00857
Jackson	0.53584	0.75404	0.21820
Kalamazoo	0.85205	0.89324	0.04119
Kent	1.02805	0.94222	-0.08583
Lapeer	0.96586	1.02754	0.06168
Livingston	1.41660	1.24423	-0.17237
Macomb	0.52261	0.56797	0.04535
Midland	0.52004	0.60791	0.08787
Monroe	0.71539	0.62881	-0.08658
Muskegon	0.65320	0.75895	0.10575
Oakland	1.55020	1.41826	-0.13194
Ottawa	0.63108	0.53397	-0.09711
Saginaw	0.87582	0.80763	-0.06819
St Clair	0.81219	0.82563	0.01345
Washtenaw	0.80889	0.73427	-0.07462
Wayne	1.05824	1.15337	0.09513
Nonmetropolitan Counties			
Alcona	0.18490	0.36233	0.17743
Alger	0.60725	0.58761	-0.01964
Allegan	0.43248	0.40761	-0.02487
Alpena	0.98822	0.90135	-0.08687
Antrim	0.55482	0.62866	0.07384
Arenac	0.99858	0.75520	-0.24338
Baraga	0.75528	0.80386	0.04859
Barry	0.99789	0.96814	-0.02975
Benzie	0.72766	0.96117	0.23351
Branch	0.80175	0.77118	-0.03057
Cass	0.76306	0.61752	-0.14554
Charlevoix	0.79961	0.64994	-0.14966
Cheboygan	0.97085	0.82353	-0.14732
Chippewa	1.32603	1.02581	-0.30022
Clare	0.99873	0.73326	-0.26547
Crawford	0.80123	0.78092	-0.02031
Delta	0.84148	0.87914	0.03766
Dickinson	0.85979	0.58353	-0.27626
Emmet	0.81565	0.79920	-0.01645
Gladwin	1.23970	1.12450	-0.11520
Gogebic	1.00350	0.92724	-0.07626

Appendix C. (c) (cont'd)

Grand Traverse	1.14450	0.88900	-0.25551
Gratiot	0.84250	0.71262	-0.12989
Hillsdale	0.64099	0.52507	-0.11592
Houghton	1.46184	1.43329	-0.02855
Huron	0.99294	0.89431	-0.09863
Ionia	0.67911	0.76861	0.08949
Iosco	1.29226	1.20551	-0.08675
Iron	1.11398	1.17019	0.05621
Isabella	0.82425	1.05274	0.22849
Kalkaska	0.55824	0.21380	-0.34444
Keweenaw	0.92549	1.62733	0.70184
Lake	2.10786	1.20603	-0.90183
Leelanau	0.66351	0.55856	-0.10495
Lenawee	0.70639	0.83056	0.12418
Luce	0.85353	0.70093	-0.15260
Mackinac	0.84632	0.86602	0.01970
Manistee	0.77153	0.83715	0.06561
Marquette	0.96952	0.97503	0.00551
Mason	0.73071	1.24995	0.51925
Mecosta	1.13069	0.90015	-0.23055
Menominee	0.66520	0.72866	0.06346
Missaukee	2.13929	1.15488	-0.98441
Montcalm	0.57690	0.51414	-0.06277
Montmorency	0.88063	1.27399	0.39335
Newaygo	0.90650	0.79512	-0.11138
Oceana	0.97064	0.83892	-0.13172
Ogemaw	0.43771	0.61807	0.18036
Ontonagon	0.48074	0.52543	0.04469
Osceola	0.54412	0.66650	0.12238
Oscoda	0.90068	0.60216	-0.29852
Otsego	0.77485	0.71423	-0.06062
Presque Isle	0.91846	0.99408	0.07563
Roscommon	1.36000	1.26382	-0.09618
Sanilac	0.74434	0.99085	0.24652
Schoolcraft	0.49818	0.94784	0.44966
Shiawassee	0.78155	0.80636	0.02481
St Joseph	0.55671	0.51792	-0.03880
Tuscola	0.79302	0.94072	0.14770
Van Buren	0.77037	0.62969	-0.14069
Wexford	0.71557	0.57245	-0.14311

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