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EXAMINING THE DISTRIBUTIONAL EFFECT OF ECONOMIC STRUCTURE WITHIN AN EXTENDED ENDOGENOUS GROWTH FRAMEWORK: A SPATIAL ECONOMETRIC PERSPECTIVE FOR REGIONAL ECONOMIC DEVELOPMENT PLANNING

by

KIM, KWANG-KOO

A dissertation submitted in partial fulfillment of

the requirements for the degree of

Doctor of Philosophy

(Urban and Regional Planning)

at the

UNIVERSITY OF WISCONSIN-MADISON

2002

A dissertation entitled

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University of Wisconsin-Madison
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degree of Doctor of Philosophy

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KIM, KWANG KOO

Date of Final Oral Examination: August 21, 2002

Month & Year Degree to be awarded: **December** 2002 **May** **August**

Approval Signatures of Dissertation Committee

Signature, Dean of Graduate School

Martin Cadwallader/EH

Committee's Page. This page is not to be hand-written except for the signatures

EXAMINING THE DISTRIBUTIONAL EFFECT OF ECONOMIC STRUCTURE WITHIN AN EXTENDED ENDOGENOUS GROWTH FRAMEWORK: A SPATIAL ECONOMETRIC PERSPECTIVE FOR REGIONAL ECONOMIC DEVELOPMENT PLANNING

Kim, Kwang-Koo

Under the supervision of Associate Professor David W. Marcouiller

At the University of Wisconsin-Madison

The distribution of income in the U.S. has been diverging among people and between regions since the late 1970s and early 1980s. Traditional neoclassical growth theory does not predict recent increases in income inequality. This research focused on the distributional effects of economic structure that shifted from manufacturing to service industries in the U.S. for the last two decades. The purpose of this research was to find linkages between economic structure and income distribution and to provide distributional implications of specific economic sectors for market-based economic development and planning practice.

To explain a spatially divergent pattern of income distribution, this research hypothesized that economic structure would be associated with income inequality. An extended endogenous growth framework was developed which included endogenous growth engines such as population, educational attainment, government decisions, and natural amenities. The framework also contained several economic structure variables including manufacturing employment, retail+service employment, tourism employment and firms, and employment and

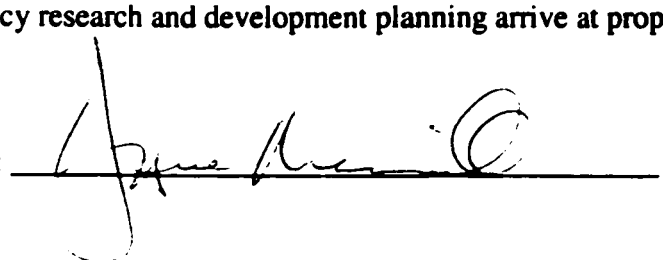
firm diversity indices. This research uniquely employed a spatial error model (SEM) to control for implicit spatial autocorrelation through the error term. The SEM provided more efficient estimation coefficients than conventional Ordinary Least Squares (OLS) models. The research region was the 242 counties of the Great Lakes states.

This research employed exploratory spatial data analysis (ESDA) to describe spatial patterns of the variables and several tools to detect spatial autocorrelation of the error term. They included global Moran's I, local indicator of spatial association (LISA), and Moran scatterplots. The analyses of global Moran's I and LISA showed the variables in spatially clustered patterns. The Moran scatterplots indicated that the error term was spatially autocorrelated and that the SEM successfully took into account the spatial autocorrelation of the error term.

This research found no conclusive evidence on the relationship between economic structure and income distribution. A general conclusion was that the linkage between economic structure and income distribution may be dynamic. The dynamic nature of the linkage between economic structure and income distribution suggested that considerable caution is needed in efforts to affect income distribution through influence on specific economic sectors. This research showed that manufacturing employment had disequalizing income effects, while retail and service sector employment did not have clear effects on income distribution in the region. These findings suggest that planners focusing on developing the manufacturing sector should have a concrete understanding of the distributional consequences of their decisions and that efforts to promote and retain retail and service industries should proceed with caution because of possible disequalizing distributional consequences of retail and service jobs. This research uniquely showed that natural amenity attributes were associated with equalizing income

distribution in the region. It was revealed that water-related amenities, a widely-appreciated natural amenity attribute in the Great Lakes region, had a significant income-equalizing relationship during the 1980s. This work also suggests that natural amenities exhibit different distributional effects. Thus, economic development planners first need to be aware of the distributional consequences of natural amenity-based development, set a clear distributional goal, and then identify region-specific natural amenities that can serve the goal.

Finally, this research demonstrated the advantage and usefulness of a spatial econometric approach to take into account the spatial processes of regional data. Specifically, this research suggests that the descriptive tools for spatial patterns of the data and the spatial error model (SEM) can help policy research and development planning arrive at proper policy implications.

Advisor's Approval: 

ACKNOWLEDGEMENTS

I would like to thank my advisor, David Marcouiller, for all of the help, support, and encouragement he has provided for me throughout my Ph.D. program. His insight and suggestions always guided me in the right direction. My thanks also go to my Ph.D. committee members who provided scholarly advice and comments. Discussions with Prof. Steve Deller were always helpful thanks to his in-depth understanding of my research issues. I also would like to thank Prof. Roger Hammer for his detailed comments on my dissertation. In addition, I always enjoyed discussing the applications of spatial econometrics with Prof. Paul Voss and Prof. Gary Green was always ready with advice whenever I faced questions.

Along with my two master degrees from the University of Minnesota (Master of Planning) and from the University of Wisconsin-Madison (Master of Agricultural and Applied Economics), this Ph.D. dissertation is the product of my academic journey in the United States. The journey could not be possible without financial support from many different sources. First, the Rotary Foundation in conjunction with the District 3750 Southern Anyang Rotary Club (Yang, Jung-Ho, 1994-95 District Governor) of South Korea, and the District 5950 Edina Rotary Club (Daniel P. Hallberg, 1990-91 District Governor) of the Twin Cities, Minnesota, made it possible for me to begin my studies at the Hubert H. Humphrey Institute of Public Affairs, University of Minnesota. In the Humphrey Institute, I am indebted to Prof. Richard Bolan; Prof. John Adams; Lee Munnich, the director of the State and Local Policy Program; and Gary DeCramer, former Minnesota state Senator.

For the first three years of my Ph.D. program at the University of Wisconsin-Madison, I received the financial support from Prof. David Marcouiller of the Dept. of Urban and Regional

Planning (URPL), and Prof. Jeff Stier of the Dept. of Forest Ecology and Management. My research with them produced my first academic publication.

I was lucky to meet Prof. Paul Voss and Prof. Roger Hammer of the Dept. of Rural Sociology. They made it possible for me to continue pursuing my Ph.D. degree after I had left the breast cancer research at the UW Comprehensive Cancer Center. Throughout the last entire year, I could focus on my dissertation project due not only to their financial support but also other physical resources they provided. I greatly appreciate their generosity.

I owe my thanks to other URPL faculty members. It was Prof. Jerry Kaufman who made it possible for me to be not just a planner but also a philosopher. I loved his planning theory class, and his retirement speech will not be forgotten. I also owe thanks to my fellow graduate students in Music Hall. I really enjoyed preparing for the Ph.D. preliminary examinations with Martin Bailkey, Samina Raja, and Mark Stevens. They provided me with great support and friendship. I wish them the best of luck.

Finally, I am deeply indebted to my family in South Korea. Though I am the only son, I missed the honorable retirement ceremony of my father after his thirty-five years in public service and also missed his sixty-first birthday. My sincerest apologies to him. My mother's hand-written letter, expressing how deeply she missed and loved me, brought me to tears. I could not have finished my academic journey in the U.S. without their unconditional love, trust, and patience. In addition, I have greatly appreciated the support of my two sisters, Kyung-Ae and Young-Ae, and my brother-in-law, Hwang, Geun-Ha. For many years, I always have received psychological comfort from the long phone conversations with them. I would like to dedicate my dissertation to my beloved nephew, Byung-Jun, and niece, Hae-Min who are the future of my family.

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CHAPTER 1

INTRODUCTION

Trends of Income Inequalities in the United States

Although the United States enjoys a higher per capita GDP and a higher per capita net wealth than any other nation, the U.S. economy faces challenges as it enters the twenty-first century. One such challenge is the lack of income equality and its related distributional issues. After a decrease following World War II, income inequality has steadily increased in the U.S. since the late 1970s and early 1980s. Harrison and Bluestone (1988) called the increase of inequality the "Great U-Turn." Freeman (1999) termed it the "New Inequality." Widening income inequality is the most evident economic trend in the U.S. (Morris and Western 1999; Chevan and Stokes 2000); the nation is becoming a two-tiered society of rich and poor people both within and across regions.

Although increasing inequality in the U. S. is not yet a domestic policy issue, concerns about increasing inequality that have until now appeared primarily within academic circles are also rising in the public realm. Robert Reich, who served as Secretary of Labor under the Clinton administration, observed the consequences of increasing income inequality and cast a dire picture for the nation if income inequality continues to increase. According to Reich (1999), if the U.S. continues its trend toward a two-tiered society, social bonds that tie America together will become weaker. Political decisions on trade, immigration, education, taxes, welfare programs, and infrastructure investment would become more difficult to make because they would have significantly different effects on the rich and the poor. Such differences could

undermine social and political capacity for democratic governance and would lead to a loss of the moral authority that has historically defined the U.S. as a nation (Reich 1999).

In a recent article, The *Economist* (2001) addressed the widening gap between the haves and the have-nots in the U.S. between 1979 and 1997. The article highlighted concern about the political and social consequences of increasing income inequality:

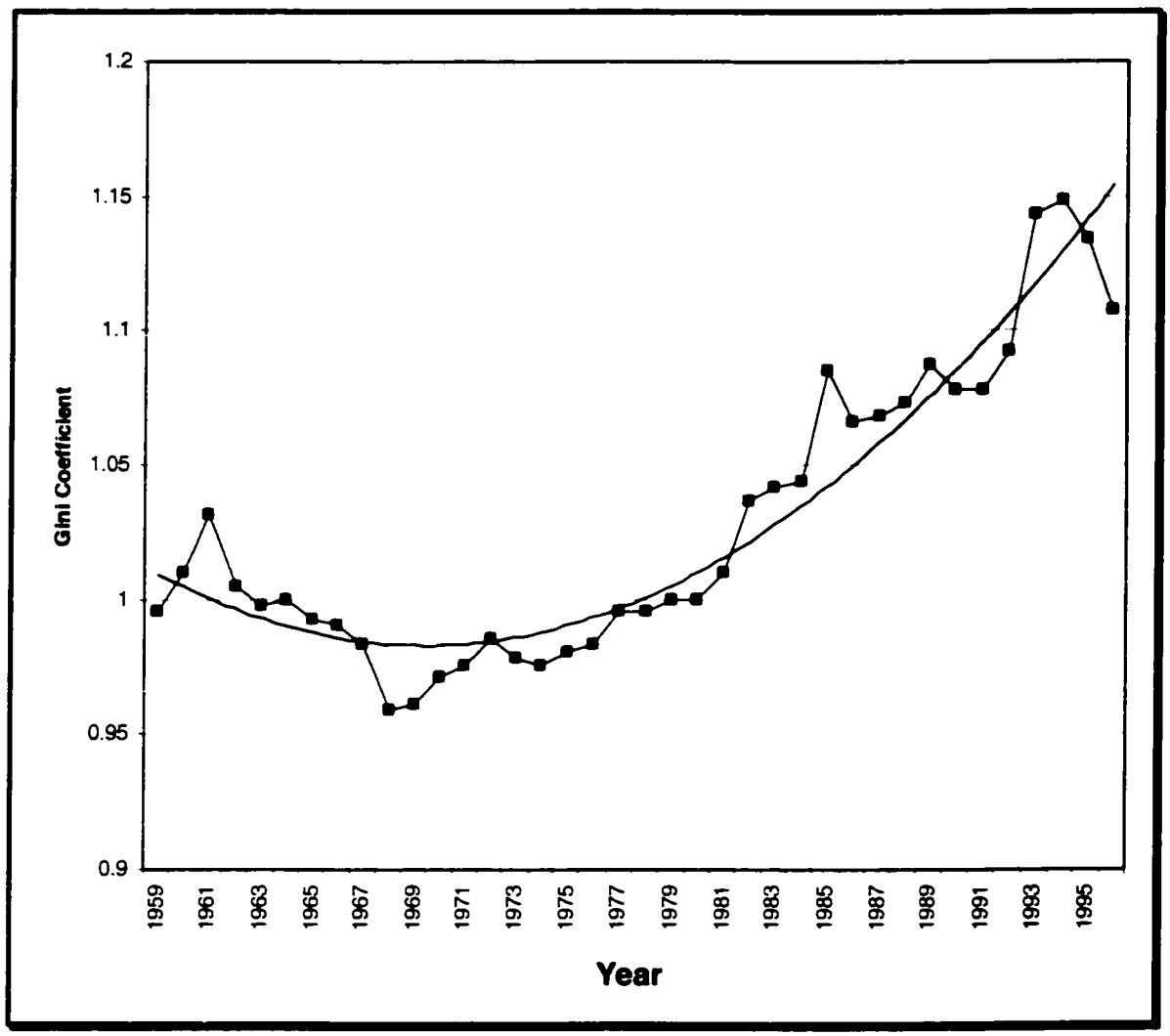
> [I]n good economic times, even the poor feel better off. In bad ones, the rich may lose the most money but the poor lose their jobs, their houses, even their family. ... That, certainly, is the danger. But how much should people (rich or not-rich) worry about it, these days? ... Yet although democracy may well mean that a backlash by the less-well-off will not become literally explosive, there are still plenty of ways in which it could be harmful. (*Economist*, p. 9)

Dire forecasts of growing inequality and the consequential mistrust of the current system conflict with the optimism of those who believe in the progression of the U.S. toward greater economic equality. Despite a steady increase in average income, a decrease in the income gap between black and white, a continuing long-term decline in poverty rates, and rising educational attainment, the recent increase in income inequality could undermine the legitimacy of the market and of the political system in the U.S.

Rising income inequality in the U.S. has been widely reported in the following three dimensions. The first dimension is an aggregate increasing trend of family income inequality regardless of their geographic location. The long-term trend of income inequality in the U. S. appears in Figure 1.1. Income inequality was lowest around 1970 and then rapidly increased up to the mid-1990s. Income inequality for U.S. family income, measure by Gini coefficient[1],

[1] The Gini coefficient is based on the Lorenz curve that shows the relationship between the cumulative percentage of total income within an economy and the cumulative percentage of income received when units are arranged in ascending order according to income. The Gini coefficient ranges from 0, indicating perfect equality, to

Figure 1.1 Trend of Family Income Inequality in the U.S., 1959-1996: Relative Gini Coefficient (1979=1.00)



Source: Gottschalk and Smeeding (2000).

1, indicating perfect inequality. The higher the Gini coefficient, the higher the degree of income inequality (Kuenne 1993).

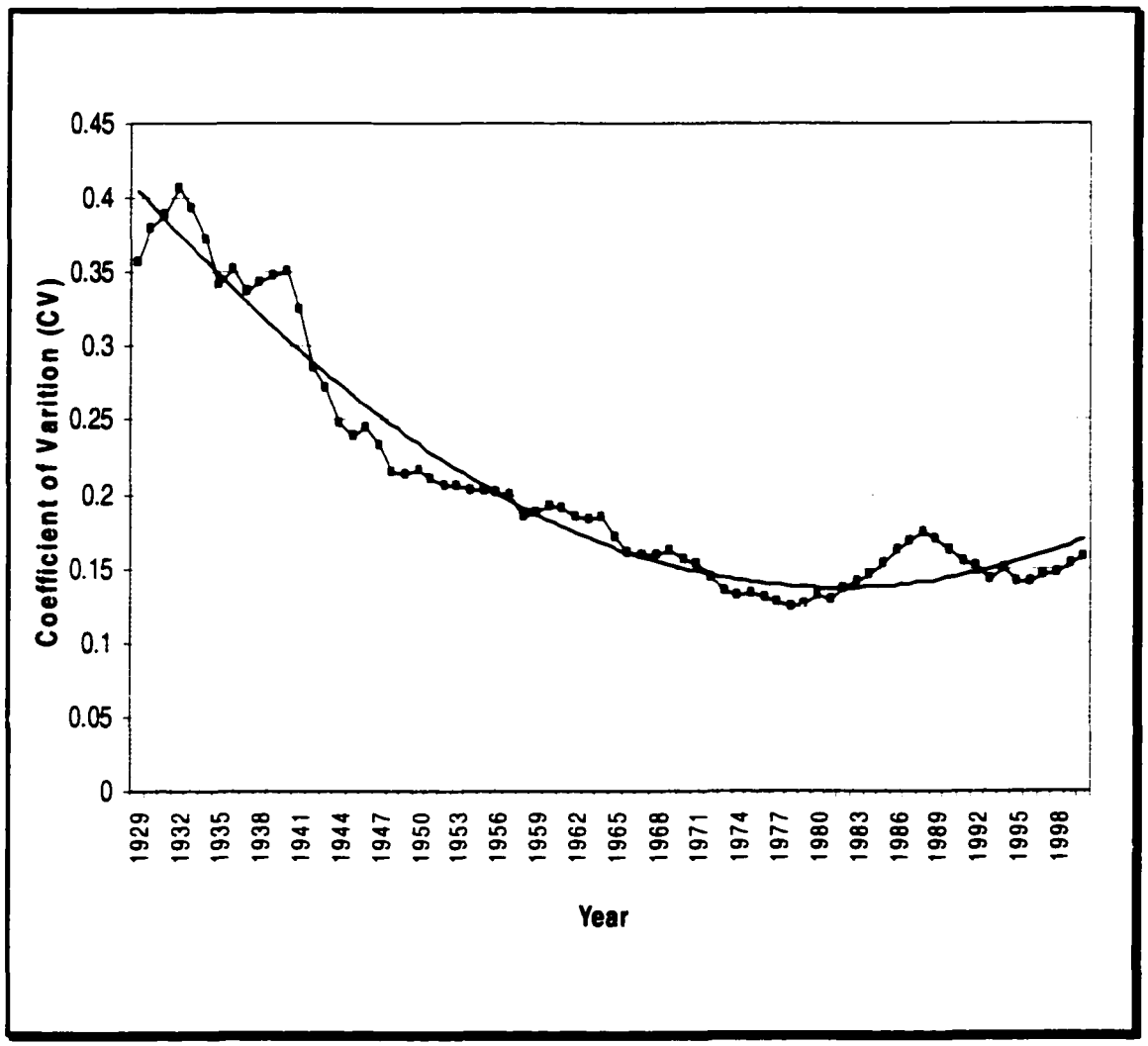
have persistently risen from 0.35 in 1970 to 0.365 in 1980, and from 0.396 in 1990 to 0.44 in 1997 (Cline 1997; Karoly 1996; Morill 2000; Rowley et al. 1991; Weicher 1997; Weiner and Monto 1998).

The second dimension of income inequality is the spatial (geographic) variation among regions in the U.S. Differences in per capita income among states have risen rapidly since 1979. Rowley et al. (1991) showed that by 1989, income inequality measured by the coefficient of variation (CV)[2] had increased 41 percent from 1979. The CV decreased in the early 1990s but then increased in the late 1990s (Figure 1.2). Many studies have found differences across regions of the U.S. both in the levels of income inequality and in trends over time (Amos 1988, 1989; Fan and Casetti 1994; Levernier et al. 1998a, 1998b; Morill 2000; Nissan and Carter 1993, 1999; Partridge et al. 1996, 1998; Carlino 1992; Danziger and Gottschalk 1993; Redman et al. 1992; Crown and Wheat 1995; Sherwood-Call 1996; Glickman 1996, 2000; Rey and Montouri 1999).

The final dimension of income inequality is income disparity within a region, especially the persistent income gaps between metropolitan and nonmetropolitan economies (Renkow 1996). Economic and demographic indicators have suggested a growing disparity between metropolitan and nonmetropolitan areas (Redman et al. 1992; Hansen 1995). Due to the strength of the recent national economic expansion, nonmetropolitan regions saw declines in unemployment, increase in per capita income, and increases in weekly earnings. The income gap between metropolitan

[2] The coefficient of variation (CV) is a measure of the dispersion of income distribution. Although the variance (σ^2) is a common measure of the dispersion of income about its mean value, σ^2 is very sensitive to inequality because σ^2 rises rapidly as the absolute spread of a distribution rises. To correct this bias, we can make the variance relative by dividing the square root of it by the mean. This yields the coefficient of variation, σ/μ. If income is distributed unequally among income groups, the coefficient of variation is high. If income is equally distributed, the coefficient has a low value (Kuenne 1993, p. 217).

Figure 1.2 U.S. Lower 48 States Coefficient of Variation (CV) of Per Capita Income, 1929-2000



Source: Crown and Wheat (1995) with CV calculation for 1994-2000 by the author.

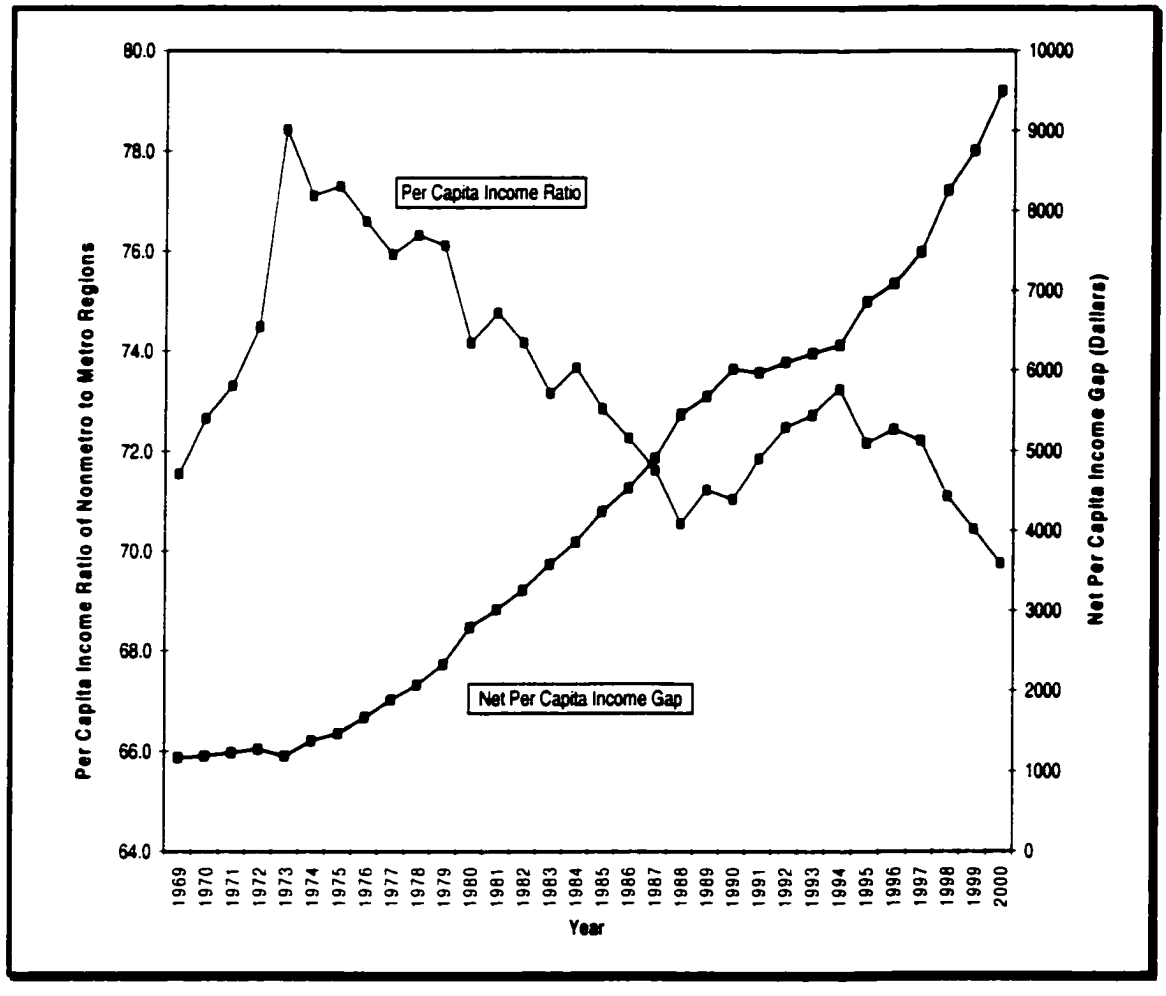
and nonmetropolitan regions, however, has been significant and persistent. The net per capita income gap between metropolitan and nonmetropolitan regions increased throughout the last three decades in the U.S. In 2000, nonmetropolitan regions lagged behind metropolitan regions by at least $9,000 in per capita income. The per capita income ratio of nonmetropolitan to metropolitan regions has declined since the mid 1970s, except during the 1988-1994 period. Strong economic growth in the 6-year period may have led to an increase in the per capita income ratio. In 2000, the per capita income ratio of nonmetropolitan to metropolitan regions decreased to an all-time record low of 69.7 (Figure 1.3).

In addition to lower incomes, nonmetropolitan regions have lagged behind metropolitan regions on other economic performance indicators. High poverty rates have persisted over many decades. Since the 1960s, poverty rates have exceeded 20 percent in almost one quarter of all nonmetropolitan counties (Nord 1997, 1998). Unemployment and underemployment rates have remained at substantially higher rates in nonmetropolitan areas than in metropolitan areas (Stabler 1999). Nonmetropolitan growth rates for overall population and employment lagged behind metropolitan growth rates (Torgerson and Hamrick 1999). Low-wage employment rates were higher in nonmetropolitan regions than in metropolitan regions because urban jobs were more likely to require higher education and specialized skills than were rural jobs (Cook and Gibbs 2000).

Explaining Increasing Income Inequalities

Increasing interpersonal, interregional, and intraregional inequalities run counter to traditional neoclassical growth theory. Neoclassical growth theory suggests that over time, per

Figure 1.3 Per Capita Income Gap between Nonmetropolitan and Metropolitan Regions of the U.S., 1969-2000



Source: Local Area Personal Income, Regional Accounts Data, Bureau of Economic Analysis, U.S. Department of Commerce, http://www.bea.doc.gov/bea/regional/reis/.

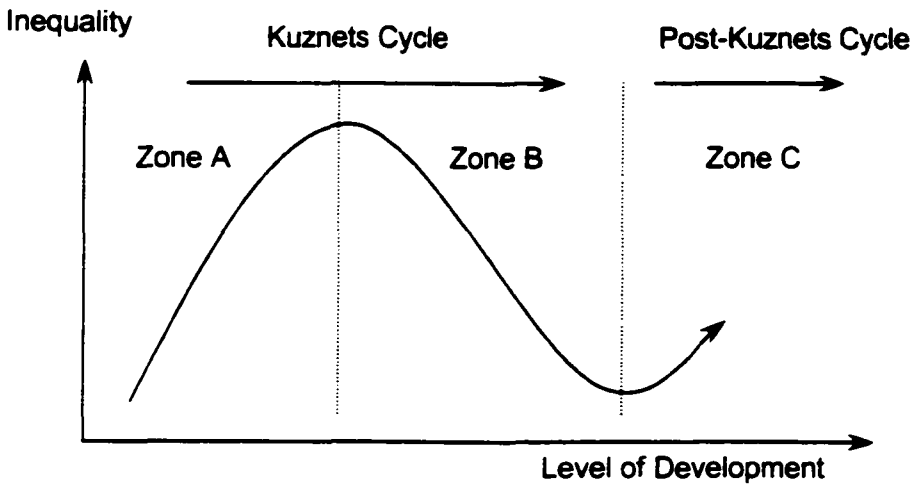
capita income converges across regions for two reasons.[3] First, the theory assumes diminishing returns to capital and labor separately and thus, additional factor inputs produce smaller increments to output in regions with higher incomes than they do in regions with lower incomes. Second, the theory assumes that if there were no barriers to migration of factor inputs, interregional differences in per capita income would tend to be minimized over time. Thus, traditional neoclassical growth theory envisions convergence in terms of personal income and regional development patterns (Sherwood-Call 1996; Coffey 1990; Ehrlich 1990; Lipshitz 1992).

Neoclassical growth theory and its convergence feature are not consistent with the recent income disparity trends in personal and regional income distribution in the U.S. After the long income convergence trend during most of the twentieth century, income dispersion has increased since the late 1970s. Bernat (2001) showed that since 1979, there was essentially no regional convergence around the U.S. Sherwood-Call (1996) also argued the possibility that regional income has stopped converging. Furthermore, Amos (1988) and Glickman (1996) hypothesized that after the end of the development cycle epitomized by the Kuznets hypothesis,[4] a new up-swing trend might have began in income distribution in the U.S. (Figure 1.4). Nielsen and Alderson (1997) supported the hypothesis of Amos (1988) and Glickman (1996) by showing

[3] The term "convergence" in this research means the dispersion or spread of income and is used to examine whether the distribution of per capita income among states or regions is becoming narrower over time; the term "divergence" refers to an increase in the dispersion of income (Sherwood-Call 1996; Bernat 2001).

[4] Kuznets (1955, p. 18) argued that "one might thus assume a long swing in the inequality characterizing the secular income structure: widening in the early phases of economic growth...; becoming stabilized for a while; and then narrowing in the later phase." His speculation on the relationship between economic growth and income inequality, then, has been termed the "Kuznets hypothesis," referring to the inverted U-shaped path of inequality with respect to economic development. He showed that as economic development progressed, personal incomes would first become more unequal and then equalize (Kuznets 1955). The U.S. followed the inverted U-shape path in income inequality over time (Williamson 1965; Williamson and Lindert 1980) until the 1970s, when the income inequality trend reversed and income disparities began to increase (Glickman 1996).

Figure 1.4 Economic Development and Changes in Inequality



Source: Glickman (1996, p. 2).

empirically that the U.S. income inequality trend might be in the transition phase from Zone B to Zone C in Figure 1.4.

The recent disparity of income distribution among persons and regions has motivated development economists, regional scientists, sociologists, and economic planners to analyze the causes of the increases in U.S. inequality. Morris and Western (1999) categorized roughly four causes of the rise in U.S. inequality: the changing demographics of the labor force, the impact of economic restructuring, the role of political context and institutions, and the dynamics of globalization.

Glickman (1996) listed the most widely cited causes as including 1) *changes in technology* that favor workers with specialized knowledge and skills, 2) *deindustrialization* that represents the shift to the service sector from the manufacturing sector, 3) *changes in the demand for and supply of labor* that make the educational premium wider among workers, 4) *declining unionization* that weakens the collective bargaining power of low-wage and low-skill works, and 5) *international trade* that results in the shifting of considerable manufacturing capacity to developing countries. There is still controversy as to what has caused the increases in income inequality in the U.S. No single factor, however, should be blamed for the complex dynamics of income inequality (Danziger and Gottschalk 1993).

The Problems

The relationship between economic development and income distribution has been a dominant research issue in regional development and planning for the last several decades. The focus of the research, however, has shifted over the period. The effect of economic growth on the pattern of income distribution has been a research focus since Kuznets (1955) raised his

inverted U-hypothesis on the distributional consequences of economic growth. The Kuznets inverted-U hypothesis, however, has remained contested (Williamson 1965; Amos 1988; Glickman 1996; Nielsen and Alderson 1997).

In their search for the determinants of growth potentials, many studies have focused on the ways that initial income distribution affects subsequent economic growth. They have examined whether poor nations or regions with high initial income inequality could experience fast growth (Clarke 1995; Tomberlin et al. 1996; Partridge 1997; Dev Bhatta 2001). The dominant view appears to suggest that initial inequality may be detrimental to subsequent growth (Bénabou 1996; Temple 1999).

Several recent studies have reported possible positive effects of initial income inequality on subsequent economic growth. Li and Zou (1998) developed a theoretical model by dividing government spending into production services and consumption services. They showed theoretically that when government consumption services entered their theoretical model, income inequality might lead to higher economic growth. Forbes (2000) used panel estimation to control for country-specific effects. She found that in the short and medium terms, the level of income inequality had a significant positive association with subsequent economic growth. Dev Bhatta (2001) also found that in the metropolitan statistical areas (MSAs) of the U.S., initial income inequality had a robust positive relationship with subsequent income growth rates. Thus, the research on the association between income inequality and economic growth may be far from resolved.

A growing literature addresses the ways that the diversification of economic structure can contribute to economic growth and stability (Attaran 1986; Sherwood-Call 1990;; Kort 1981, 1991; Malizia and Ke 1993; Siegel et al. 1994, 1995b; Wagner and Deller 1998). Although there

is some inconsistency in early empirical findings on the diversity-stability/growth relationship, the regional economic literature tends to agree that a diversified economic structure may have less instability, less unemployment, and faster economic growth (Malizia and Ke 1993; Sherwood-Call 1990; Wagner and Deller 1998).

Regional science has accumulated evidence on the linkage between economic growth and income distribution and on the linkage between economic growth and economic structure. The traditional linkages between economic growth and income distribution or between economic growth and economic structure, however, may have changed because the U.S. has experienced increasing income inequality and economic restructuring over the last two decades. These changing environments may require reexamination of existing knowledge and understandings of the traditional linkages between economic growth and income distribution or between economic growth and economic structure in regional development theory and planning.

In the U.S., economic expansions have tended to increase labor demand and to favor the poor over the rich, resulting in an improved income distribution and a decreased poverty level. Although the U.S. experienced its second longest economic expansion from 1983 to 1989, the expansion led to only a modest decline in poverty. Furthermore, family income inequality increased steadily during the same decade (Blank 1993; Blank and Card 1993). Blank (1993) argued that

> [i]t would have been reasonable to expect that the strong expansion that followed would have produced a sharp decline in poverty. This did not occur. While poverty clearly declined over the entire period of the expansion, it still stood at 12.8 percent in 1989, well above its historic low of 11.1 percent in 1973, and at about the same level as in 1980. The macroeconomic expansion did not bring down poverty as quickly as historical evidence would have indicated. (Blank 1993, p. 21)

While Blank and Card (1993, p. 285) suggested that "economic growth in the 1980s ... seems to have had far weaker redistributive effects," they questioned whether income distribution and growth remained linked. The linkage between economic growth and income distribution remained weak during the 1990s. The 1990s saw very strong economic expansion initiated by financial industry and information technology-based venture capital firms. However, Wyly et al. (1998, p. 7) noticed that "the processes driving national growth continue to reinforce inequalities in opportunity for individuals and communities."

This loose connection between economic growth and income distribution becomes a challenging issue in regional development theory and planning. Economic restructuring of the U.S. for the last two decades, namely a shift toward a service-dominant economy, has also led to general dissatisfaction with the interpretation and ideology of the old approaches in regional development theory and planning. Alonso (1989, p. 221) claimed, "it cannot be doubted that the economic structure of every region is changing, different regions in different ways, but understanding of the nature of these changes is still very imperfect." Alonso (1989, p. 236) also argued, "at this time there is very imperfect understanding of the structure and interconnection of economies at the regional, national and international levels."

Recent economic restructuring has revealed the limitations of the existing sets of empirical evidence upon which regional development theory and planning is based. While the linkage between economic growth and income distribution may have eroded in the U.S., there is growing interest in the effects of a change in economic structure on income distribution. The nature of the inter-linkage between economic structure and income distribution, however, is not yet thoroughly understood. Thus, this dissertation research is an effort to gain a better understanding of the relationship between economic structure and income distribution by

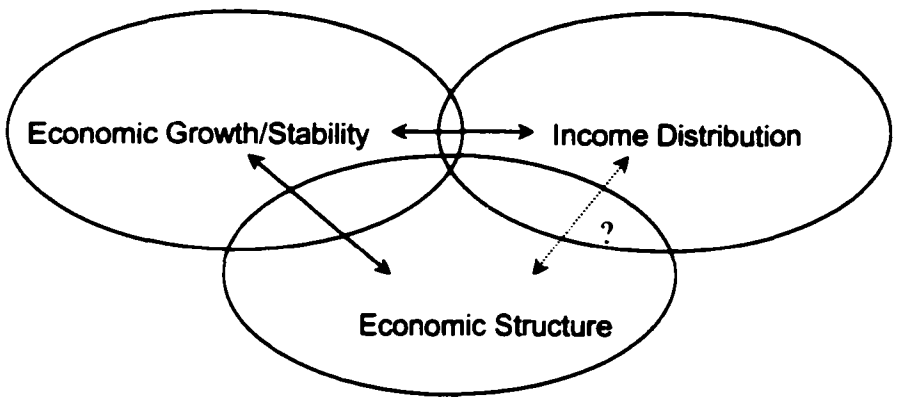
searching for a linkage between them (Figure 1.5). The goal of this research is to provide distributional implications to regional economic development and planning.

In addition to the lack of understanding of the theoretical and empirical relationship between economic structure and income distribution, there are methodological complexities in regional economic development and planning analysis that require a specific approach. Economic activities including growth or structural changes evolve over space. Those economic activities are usually not homogenous across regions and their spatial dynamics are significant. Regional science has long been aware of the importance of the spatial characteristics of economic activities but has relied on traditional and aspatial statistical methodology. The advancement of computers and geographic information systems (GIS) allows regional scientists to apply advanced spatial statistical analyses that incorporate spatial distribution patterns of economic activities. This dissertation introduces to regional science spatial econometrics as an advanced statistical method.

Progressive Planning Traditions and Income Distribution

The planning profession has evolved out of two distinctive intellectual traditions: the scientific rationalist planning tradition and the progressive tradition (Klosterman 1978). The rationalist tradition, based on a western faith in rationality and science, defines planning as a value-free technical process of applying objective and scientific methods to the affairs of society. The progressive planning tradition sees planning as a means for changing and improving society and thus requires the planner to serve the public interest and to protect the disadvantaged in society. Even when growth was the only dominant value worth striving for, the planning profession was greatly concerned with questions of equity (Friedmann and Weaver 1979).

Figure 1.5 Three Linkages of Regional Economic Development and Planning



The progressive planning tradition prevailed in early planning practice that focused on solving the grim living conditions of the working class in industrial cities caused by untrammelled capitalism (Hall 1988; Taylor 1998; Beauregard 1990). Early planners at the turn of twentieth century thought that poor living environments might cause urban problems. They made efforts to ameliorate urban conditions and to improve physical environments through physical planning and urban design. These early planning practices continued in environmental determinism in the context of the progressive planning tradition.

The progressive tradition in planning evolved significantly during the civil rights movement and the urban renewal era of the 1960s (Friedmann 1987; Brooks 1988). Davidoff (1965) suggested "advocacy planning" in the context of a pluralistic political process that would force public agency plans to compete with other alternative plans that represented the needs of the poor. As the planning profession became a bureaucratic apparatus in governments, Davidoff (1975) urged the profession to work toward greater equality and redistribution between citizens in communities.

The progressive planning tradition played a significant role in the "equity planning" of the city of Cleveland from 1969 to 1979 under the direction of Norman Krumholz (Krumholz et al. 1975; Krumholz 1982). Equity planning was designed to promote "a wider range of choices for those...who have few, if any choices" (Krumholz et al. 1975, p. 299) and was "a conscious attempt to devise redistributive policies in favor of the least powerful and to enhance avenues of participation" (Krumholz and Clavel 1994, p. 1).

Although equity planning affected the field of planning in academia, it was rarely employed by other American cities and its practice did not much continue into the 1980s (Kaufmann 1982). The progressive planning traditions began to wane when the conservative

Reagan administration came into the executive seat in the 1980s. The post-war social democratic and welfare state was replaced with a free market liberalism that emphasized supply-side economics, deregulation, privatization, reform of unionism, and minimal government involvement. U.S. society prioritized values to growth and efficiency over distribution and equity.

Although the U.S. achieved lower inflation, lower unemployment, and increasing productivity (Taylor 1998; Newman and de Zoysa 2001), the *laissez-faire* market supremacy of the U.S. economy during the last twenty years has led to a new set of economic and social problems. Deregulation, which was predicted to lower prices through more competition and innovation, resulted in increased prices and the concentration of ownership (*Wall Street Journal* 2002). The recent rise of oligopolies in American industries may be detrimental to consumers and to economic progress in the long run (Coy 2002; *Wall Street Journal* 2002). Unregulated private markets, especially financial markets, might lead to inefficient resource allocations and increase decision-making uncertainty.

Progressive public policies that address the redistribution of income have a long history in the U.S. From the New Deal era to the Great Society era, many income-transfer programs were enacted including Social Security, Unemployment Insurance, Aid to Families with Dependent Children (AFDC), Medicaid, and Food Stamps (Danziger et al. 1981). Public spending on income-transfer programs grew rapidly until the 1980s. During the 1980s, the Reagan administration, however, retrenched income-transfer programs with pieces of three legislation; the Omnibus Budget Reconciliation Act of 1981, the Social Security Amendments of 1983, and the Family Support Act of 1988. Finally, the Personal Responsibility and Work

Opportunity Reconciliation Act of 1996 ended federal guarantees of pubic assistance (O'Connor 1998).

Since the 1980s, U.S. market supremacy has significantly transformed government roles in building a social safety net for poor people. The federal government has begun to back away from its role in the redistribution of income. Market-based solutions have been emphasized in approaches to improving individual welfare. Also, more responsibility has shifted to state and local governments to provide social services. State and local governments, however, have been more interested in creating competitive advantages for economic development than in providing such services (Leatherman and Marcouiller 1996a; Leatherman and Marcouiller 1999). The income distribution issue has begun to "take a backseat to economic development's issues of efficiency and growth" (Leigh 1995, p. 94). Leigh (1995, p. 96) called for "systematic consideration of the impacts of our efforts on distribution of income" in local and regional economic development.

The neo-conservatism shift in U.S. politics requires that progressive planning take alternative approaches to be effective within current market-based economic development practices. Leatherman and Marcouiller (1999) suggested that local economic development policy could affect income distribution patterns through influencing the growth of specific economic sectors. They, then, emphasized the importance of identifying the distributional impacts of specific economic sectors.

Following this suggestion of Leatherman and Marcouiller (1999), this research is an effort to extend the progressive tradition of planning into economic development and planning practices. While seeking the relationship between economic structure and income distribution, this research examines the distributional effects of specific economic sectors in a regional

economy. Ultimately, this research focuses on understanding distributional considerations within political decision-making processes of communities or regions.

Conceptual Framework and Research Outline

The objective of this dissertation research is to enhance understanding of the relationship between economic structure and income distribution. In order to achieve this goal, this research develops a conceptual framework based on both "aspatial" and "spatial" dimensions of deindustrialization in the U.S. The "aspatial" dimension is the relationship between deindustrialization and its distributional effects. Deindustrialization, also termed "economic restructuring," is marked by the relative shift of employment away from the manufacturing sector and into the service sector. Economic restructuring is often mentioned as the most significant and direct source of increasing income inequality (Grubb and Wilson 1989, 1992; Chevan and Stokes 2000). The research literature hypothesizes that the shift of employment away from manufacturing and toward services increases income inequality.

The effects of economic restructuring on increasing income inequality remain unclear and are inconsistent. In their review of the debates over the origins of the rise of U.S. income inequality, Morris and Western (1999) concluded that the empirical findings concerning the effects of economic restructuring on inequality are not consistent. Chevan and Stokes (2000, pp. 367-368) also succinctly summarized that the empirical studies showed different findings ranging from no effects to significant disequalizing effects of economic restructuring on income inequality.

The "spatial" dimension of deindustrialization focuses on the efforts that rural regions have made in response to their changing economic environments. The efforts of rural regions are

given little recognition in the current literature on economic restructuring. But rural regions in the U.S. have experienced dramatic economic restructuring as a result of technological development, global competition, and increasing environmental awareness (Weber et al. 1988; Galston and Baehler 1995; Pulver 1995; Torgerson and Hamrick 1999; Johnson 2001). Over the last several decades, the economic base of rural regions first shifted from extractive industries (farming, forestry, fishing, and mining) to the manufacturing sector, and then to the low-wage service sector (Bluestone and Hession 1986; Dillman 1986; Paarlberg 1986; Luloff et al. 1994; Galston and Baehler 1995; Ramawaswamy and Kuentzel 1998).

These shifts in rural economic bases have led rural regions to search for economic development alternatives for sustainable employment opportunities and income sources (Flora and Flora 1988; William and Shaw 1988). Recently, some rural regions have begun to develop their natural amenities as an economic alternative (Pezzini 2001; Isserman 2001). Tourism and recreation, which take advantage of natural amenities, have become popular parts of rural development strategies. Since the 1980s, amenity-rich rural regions have made considerable efforts to develop tourism and recreational opportunities (Kieselbach and Long 1990; Edgell and Harbaugh, 1993; Frederick 1993; Leatherman and Marcouiller 1996a, 1996b, 1999; Luloff et al. 1994; Marcouiller 1997; Wilson et al. 2001).

It has been suggested that natural amenities can play a significant role as a regional economic growth engine. Specifically, it is hypothesized that natural amenities and amenity-based tourism development bring jobs and income into rural regions (Ashworth 1992; Johnson and Beale 1998; Marcouiller et al. 2002). Recent studies testing this hypothesis found positive impacts of amenity-led tourism and recreational development on rural growth in terms of

population, employment, and income (McGranahan 1999; English et al. 2000; Deller et al. 2001).

On the other hand, Smith (1989) and Ashworth (1992) have argued that tourism development may lead to uneven income distribution as tourism industries usually provide a high proportion of seasonal, temporary, low-paying, and dead-end jobs (Frederick 1993). However, few studies have examined the distributional effects of the emerging rural tourism industry on regional economies (Marcouiller 1997). Thus, it is worth examining the distributional concerns of tourism development and natural amenities to determine their impact on regional economies.

These conceptual issues raise the following research question: Is economic structure related to income distribution? Specifically, are the extent and structure of specific sectors such as manufacturing, services, and tourism related to the level and the change of regional income distribution?

This research hypothesizes that a region's economic structure is associated with its income distribution. No concrete theoretical framework is yet available upon which to base a hypothesis regarding the relationship between economic structure and income distribution. As traditional neoclassical growth theory does not explain the recent divergent trend in income distribution, this research employs an endogenous economic growth framework that may provide useful insight for understanding the recent increasing trend of income inequality. In addition, unlike neoclassical growth theory, which relies on exogenous technology as a growth engine, an endogenous economic growth framework can allow communities and regions to employ indigenous growth factors such as human capital, education, infrastructure, and natural amenities. Thus, this research reviews the endogenous growth literature in order to develop an

empirical framework. The developed framework is then applied to a sub-region of the Great Lakes states.

The study region for this research is the 242 counties of three states in the Great Lakes Region: Michigan, Minnesota, and Wisconsin. This research focuses on a region rather than on the nation as a unit of analysis to assess the set of regional development and planning implications. However, the study region has experienced analogous trends of economic structure that the U.S. as a whole has gone through and thus is somewhat representative of the nation. During the 1970-1999 period, manufacturing employment declined by around 50 percent and service employment increased by 56 percent in the U.S. as a whole; in the study region during the same period, the former declined by 40 percent and the latter increased by 62 percent.

The research period covers the 1980-1990 period, that represent the trends of income inequality and economic restructuring. Major economic structural changes occurred throughout this period. These structural changes included an increase in service activities, the introduction of information technology, and increasing global competition. During the 1970s, manufacturing firms located into rural regions but this trend reversed in the 1980s. As they continue to lose economic opportunities in the manufacturing sector, rural economies have relied more and more on consumer-related service activities (Kassab 1992).

Demographic and socio-economic data used in this analysis are from the U.S. Census of Population and Housing for 1980 and 1990, the Bureau of Economic Analysis's Regional Economic Information System (BEA-REIS), the City and County Data Book, and County Business Patterns (CBP). Natural amenity data representing a set of endogenous growth variables are from the National Outdoor Recreation Supply Information System (NORSIS) data set maintained by the USDA Forest Service.

This research employs a robust regression analysis that is based on traditional ordinary least squares (OLS). In addition, this research extends the work of Anselin (1988), LeSage (1997), and others by incorporation of a "spatial econometrics" approach into regional analysis. A region is a space in which natural, social, and economic activities evolve. These activities can be perceived as spatial processes and can be either homogenous or heterogeneous. A given region, however, is usually different from other regions because each region can have unique natural resource endowments, human and physical capital resources, institutional environments, and sectoral structures and linkages. Therefore, empirical studies in regional economic development theory and planning need to employ advanced estimation methods that can incorporate the specific spatial characteristics of a region. This research, thus, allows comparison of a traditional OLS estimation and a spatial econometrics estimation.

Organization of the Study

This research is presented in five chapters including this introduction as Chapter 1. Chapter 2 is a literature review that begins by discussing briefly the empirical limitations of neoclassical growth theory in explaining the recent trend of income inequality. It then turns to the newly evolving endogenous growth theory to provide theoretical evidence on a divergence process in regional development. Chapter 2 also reviews the literature on the relationship between economic structure and income distribution. This literature review begins with the empirical findings of recent economic restructuring studies in various disciplines. It covers the empirical efforts of regional science to understand the effects of the diversity of economic structure on regional economies. Finally, Chapter 2 discusses the complex issues of recent tourism and recreational development based on natural amenities in rural regions.

Chapter 3 outlines several conceptual issues, research methods, data, and measurements. This chapter begins with discussing several alternative approaches to assessing the relationship between economic structure and income distribution. This chapter then develops testable hypotheses that are based on the conceptual discussions. It describes the procedures of defining and measuring variables employed in the research. It then specifies two empirical estimation models and introduces three research methods: 1) robust regression, 2) exploratory spatial data analyses (ESDA), and 3) spatial econometrics estimations. Finally, this section discusses the regional characteristics of the research region.

Chapter 4 discusses the research results of the specified empirical models. This chapter first evaluates two estimation models and examines the results of four different exploratory spatial data analyses for detecting the existence of spatial autocorrelation. Then, this chapter concludes with an in-depth discussion of the specific estimation results from robust regressions and spatial econometrics estimation.

The final chapter, Chapter 5, summarizes the empirical findings and discusses policy implications including the linkage between economic structure and income distribution, retail and service sector development, tourism and recreational development, natural amenities, and methodological issues. It also discusses research limitations and future research needs.

CHAPTER 2

LITERATURE REVIEW

Neoclassical Growth Theory

Neoclassical growth theory has been a dominant explanatory theory in regional economics for the last five decades. The common basis of neoclassical growth theory starts with perfectly competitive markets, identical rational individuals, and production technologies exhibiting diminishing returns to capital and labor. The theory also assumes an open economy for free factor mobility between regions without any barriers or transaction costs. Given equilibrating factor markets, an integrated national economy is hypothesized to move over time toward a general convergence of regional income (Ehrlich 1990; Hewings 1990). Thus, the theory suggests that regional disparities result from factor market imperfections or from the temporal lags inherent in the process of development. Regional inequalities may not be persistent because such inequalities activate self-correcting forces to inter-regional differentials in prices, wages, capital, and labor, thus imparting a strong tendency toward regional convergence (Suarez-Villar and Cuadarado Roura 1993; Martin and Sunley 1998).

The convergence property of neoclassical growth theory has recently received little confirmation in the empirical literature. Cross-national studies have failed to show empirical evidence for the convergence of income or gross national products (Ehrlich 1990; Barro 1991, 1996; Button 1998; Temple 1999). U.S. studies have also reported an interruption of the convergence process in the U.S. During the 1980s, per capita earnings tended to diverge across U.S. regions (Carlino 1992; Carlino and Mills 1996). Per capita income among U.S. states also diverged rapidly after years of convergence until the late 1970s (Coughlin and Mandelbaum

1988; Rowley et al. 1991). Wyly et al. (1998) and Morrill (2000) suggested that the robust economic growth of the 1990s aggravated the diverging trend through technological change, global competition, demographic changes, deregulation and tax change, or selective flows of jobs and wealth in the U.S.

In addition, neoclassical growth models assume diminishing returns to capital. This assumption predicts that as the stock of capital grows, economic growth slows and ultimately comes to a halt. That is, neoclassical growth models cannot generate sustainable economic growth. For economic growth, neoclassical models rely on exogenous technological progress, for which the models provide little explanation. Growth-inducing technological progress does not occur within neoclassical models and thus, is exogenous.

Although neoclassical growth models attribute a larger proportion of economic growth to technological progress, they pay much attention to inter-regional factor mobility and little to the inter-regional diffusion of technical innovation (Richardson 1969). They do not assign distinct productive roles to human capital or to governmental policy (Ehrlich 1990). Nor do neoclassical growth models appreciate the endogenous growth potential of backward regions through policy-driven infrastructure investment or through comparative advantages such as lower labor costs and natural amenities (Suarez-Villar and Cuadarado Roura 1993).

Endogenous Growth Theory

Endogenous growth theory focuses on the importance of economies of scale, agglomeration effects, and knowledge spillovers and suggests that "economic growth tends to be faster in areas that have a relatively large stock of capital, a highly educated population, and an economic environment favorable to the accumulation of knowledge" (Button 1998, p. 146).

Recent extensions of endogenous economic growth theory suggests that cumulative causation effects[1] of those market forces cause the concentration of capital, labor, and outputs in some regions at the cost of other regions so that unbalanced regional development is self-reinforcing rather self-correcting. The theory explains the possibilities of divergent regional development patterns and income disparities (Krugman 1991, 1999; Button 1998; Martin and Sunley 1998).

Endogenous growth theory purports to demonstrate that the engines of economic growth, and correspondingly long-term growth rates, can be explained by the theory. A key feature of endogenous growth theory is technological innovation that is the outcome of purposive and profit-seeking behavior on the part of firms. By allowing for incomplete competitive markets and increasing returns to scale in technology, innovators can and do earn short-term monopolistic rents. Because firms can capture short-term monopoly rents by investing in new technologies or innovation, the depreciation of capital accumulation can be offset and steady-state economic growth can be internalized in the economy (Grossman and Helpman 1994; Aghion and Howitt 1998; Barro 2000b).

Determinants of Endogenous Growth

Endogenous growth theory, also labeled new growth theory[2], explores the possibility of economic growth through profit maximizing forces. In addition to the capital accumulation in

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[1] Concepts of endogenous growth theory are not new. Myrdal suggested the cumulative causation hypothesis to predict regional income divergence in the 1950s. He (1957, p. 26) argued that "the play of forces in the market normally tends to increase, rather than to decrease, the inequality between regions." Kaldor (1970) also argued that the principle of cumulative causation refers to increasing returns to scale that may favor the rich regions and restrain development in the poor regions (Richardson 1973).

[2] Several different terms have been used to identify recent economic development approaches based on endogenous growth theory: *development from below* (Martin and Sunley 1998), *growth from within* (Barkley 1998),

neoclassical growth theory, endogenous growth theory makes efforts to identify internal "engines of growth" that cause spillovers or externalities, leading to faster economic growth.

Three empirical research themes have evolved in the literature of endogenous growth theory (Ehrlich 1990). First, most endogenous growth models view new technology and knowledge as the primary engine of growth. These models try to interpret and analyze the specific role of technological change as the outcome of entrepreneurial decisions motivated by market profit incentives (Romer 1990; Goel and Ram 1994; Grossman and Helpman 1994; Aghion and Howitt 1998; Keely and Quah 2000). These models emphasize the role of public policies to provide research and development subsidies and to protect intellectual property rights on innovations (Aghion and Howitt 1998; Stough 1998).

Second, endogenous growth models focus on the size and characteristics of the market in conjunction with technological innovation. The models assume that the market size should be sufficiently large to both to recuperate the fixed setup costs of innovations and to induce more research from the frequent interactions of diverse people with ideas and skills (Sørensen 1999; Maki and Lichty 2000). Economies which have a large market size and especially, have a large stock of educated human capital may grow faster than economies with smaller markets (Lucas 1988; Becker et al. 1990; King and Rebelo 1990; Barro 1991, 2000b; Mankiw et al. 1992; Romer 1990; Lensink and Kuper 2000).

Finally, endogenous growth models suggest the pro-active roles of government to overcome persistent economic differences between regions (Button 1998) because the key assumptions of endogenous growth theory - increasing returns to scale and imperfect competition

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locally induced development (Coffey 1990), *localized endogenous economic development* (Martin and Sunley 1998), and *indigenous development* (Martin and Sunley 1998).

– imply the very real possibility of divergence in regional development pattern. Thus, a variant of endogenous growth focuses on the effects of public policy decisions in logistic infrastructure (communication and transportation, government consumption, or taxation) as key determinants of economic growth (King and Rebelo 1990; Aschauser 1990; Munnell 1992; Berndt and Hansson 1992; Grimlich 1994; Andrews and Swanson 1995; Button 1998; Boarnet 1998; Rosser 1998; Sørensen 1999; Barro 2000b).

Shortcomings of Endogenous Growth Theory

The literature on endogenous growth theory, however, has yet provided systematic empirical evidence to formalize policy descriptions for endogenous growth (Ehrlich 1990; Pack 1998; Button 2000). The literature on endogenous growth theory is growing in terms of alternative variants that are providing unique insights into different policy options (Martin and Sunley 1998). The literature, however, is relatively new to provide systematic evidence that supports one specific approach over another. Nearly all endogenous growth theories have emphasized the importance of knowledge spillovers or other externalities. Unfortunately, the theories have not lent themselves to consistent and straightforward empirical testing (Grossman and Helpman 1994; Pack 1994).

The various specifications of endogenous growth theories tend to concur that physical capital accumulation alone is not sufficient for growth because all production, including investment in physical capital, is subject to diminishing returns. Thus, endogenous growth theory emphasizes, as the engine of growth, knowledge in either embodied human capital or disembodied technological innovation. The theories also postulate that technological innovations are directly affected by the stock and flow of human capital in an economy. It is not

certain, however, that investment in human capital alone is sufficient to induce strong increasing returns and sustainable growth (Stough 1998).

The role of government that flows from endogenous growth theory is to provide R&D subsidies, protect intellectual property rights, and invest in public infrastructure, separately or together, in order to induce more R&D and create favorable environment for innovation. While national governments have a predominate role in endogenous growth theory, the theory provides limited policy implications for regional or local governments that have taken much responsibility for economic development (Leigh 1995). The role of regional institutional dynamics and governance needs to be further explored within the endogenous growth framework (Stough 1998).

Innovation-based endogenous growth theory also tends to ignore the growth potential of natural resource availability. U.S. history shows that the sources of growth are not only due to technology and knowledge or physical and human capital accumulation but also natural resources. Romer (1996) pointed that the abundance of natural resources in the U.S. was played as a comparative advantage and argued that natural resource development eventually allowed to "create a technological lead in manufacturing that persisted well into the 20th century" (p. 204). Endogenous growth theory can consider natural resource development to be an endogenous growth process with dynamic comparative advantage (Suarez-Villa and Cuadrado Roura 1993).

Endogenous growth theory explains the existence of regional growth disparities that result from differentials not only in technological innovation but also in population growth, education, and public policy decisions. They, however, has not been applied to understanding recent increases in income inequality of the U.S. for the last two decades.

The increases in income inequality can be seen as disproportionate concentrations of monopoly rents from the major breakthroughs in information and communication technologies. The economic boom of the 1990s may show that those monopoly rents were concentrated disproportionately to venture capitalists or inventors who lived in metropolitan regions. Then, this dissertation is an effort to understand recent increases in income inequality by employing an analytical framework of endogenous growth theory.

Economic Restructuring and Income Inequality

There is now general consensus that the trend of income inequality has been increasing since the 1970s. Although many efforts have been made to trace the increasing trend to different causes, there is little explanatory consensus. The debate over the causes of rising U.S. inequality covers a wide range of issues but in general, they fall into two basic approaches. The first approach emphasizes the effects of economic structural changes on increasing income inequality (Bluestone and Harrison 1982; Harrison and Bluestone 1988; Danziger and Gottschalk 1993; Nielsen and Alderson 1997). The second approach focuses on the effects of changes in demographic characteristics on income distribution (Grubb and Wilson 1992; Bird 1998; Chevan and Stokes 2000).

This research focuses on the first approach to assessing a relationship between economic structure and income distribution. This research also incorporates demographic variables into the endogenous growth framework in Chapter 3. Empirical studies tend to agree on the effects of the following demographic change: female labor participation (negative), female-headed households (positive), elderly (negative), immigration (positive), and less educated people (positive) (Nielson and Alderson 1997; Morris and Western 1999; Chevan and Stokes 2000).

The literature is inconsistent with respect to the effects of economic restructuring on income distribution. Grubb and Wilson (1989) showed that employment shifts across sectors were likely to have much more significant impacts than demographic changes would have on the increase in inequality. Thus, this section reviews empirical studies on the effects of employment shifts on income distribution.

Effects of Economic Restructuring on Income Inequality

Economic restructuring refers to the relative employment shift from manufacturing to the service sector. Such employment shifts are believed to be detrimental to the working classes as manufacturing employment has traditionally played an equalizing role in income distribution and has provided middle income for the blue-collar classes. High productivity, strong unions, a narrow wage structure, and the economic dominance of manufacturing industries provided good wages for relatively unskilled workers. The loss of such income-equalizing manufacturing jobs since the 1970s has contributed to income inequality (Bluestone and Harrison 1982; Harrison and Bluestone 1988; Sassen 1990; Kassab 1992; Chevan and Stokes 2000).

The distributional effects of economic restructuring, meanwhile, have coupled with the dualistic characteristics of the service sector. A growing body of studies on the job quality and earnings distribution of the service sector showed that this sector produced a larger share of low-wage jobs, especially in personal service industries, than did the manufacturing sector, though professional service industries such as financial and advanced corporate services generated a larger share of high-paying profession jobs (Smith 1993-2). This wide variation of wage structures in the service sector is assumed to be disequalizing for income distribution (Harrison and Bluestone 1988; Nelson and Lorence 1988; Sassen 1990; Kassab 1992; Kassab et al. 1995).

Early studies generally supported the proposition that employment shifts away from manufacturing and toward services were disequalizing for income distribution (Hodson and Kaufman 1982; Bloomquist and Summers 1982). Nileson and Alerson (1997) investigated the effects of the "deindustrialization" of U.S. counties of 1970, 1980, and 1990. Following the Harrison and Bluestone hypothesis that manufacturing jobs have equalizing effects, they consistently found a negative and significant association of manufacturing employment with inequality. They found that the magnitude of the estimated coefficients of the manufacturing employment variable decreased throughout the three decades, and concluded that the decline in manufacturing employment might have affected the recent upswing of inequality.

Chevan and Stokes (2000) found that changes in manufacturing employment were associated with changes in family income inequality in the 1970s, but not in the 1980s. Only in the 1980s did the service sector begin to have significant disequalizing effects. They concluded that declines in manufacturing employment over the last two decades have increased family income inequality.

While controlling for demographic characteristics, Nelson and Lorence (1988) focused on the distributional effects of the service sector of the 130 largest metropolitan areas in the U.S. They found that service sector employment increased income inequality. Lorence (1991) and Bernhardt et al. (1995) found that while employment growth in the service sector tended to reduce gender inequality with increased job opportunities for females, it was likely to result in lowering wages for males and thus contributed to overall inequality. They found that growth in personal service jobs had detrimental effects on median wage levels. Kassab et al. (1995) argued that "many jobs in the service sector pay less, offer fewer benefits, and are more likely to be part-time or temporary than those in non-service sector industries, particularly manufacturing" (p. 67).

Kassab (1992) researched the influences of the service sector on community well-being in the Mid-Atlantic region from 1969 and 1979. She found that low-wage employment growth in the service sector had a positive impact on aggregate income growth, especially in rural communities. Her study, however, was inconclusive with respect to the distributional consequences of growth in the service sector. Kassab et al. (1995) found that declines in manufacturing employment undermined household well-being. Their study (Kassab et al. 1995) indicated that the jobs of service industries might not be an equivalent substitute for traditional high-paying manufacturing jobs.

The study of Lobao et al. (1999) provided puzzling findings. It focused on the role of industrial structure and institutional arrangement on income growth and inequality for U.S. counties in 1970 and 1990, respectively. The study found that core manufacturing employment and core service employment contributed to increasing family income both in 1970 and in 1990. They also found that all of the three industrial structure variables – core manufacturing, periphery manufacturing, and core service – had equalizing effects on income distribution both in 1970 and in 1990. Their study, however, did not show the distributional impacts of low-wage service industries.[3]

Grubb and Wilson (1989) decomposed the sources of increasing inequality in wages and salaries between 1960 and 1980 into sectoral shifts from manufacturing to services, regional shifts from the Snowbelt to the Sunbelt, and demographic changes. They found that economic restructuring seemed to be much more significant than regional shifts and demographic changes in the increase in inequality. Furthermore, they argued that the increase in inequality seemed to

[3] The Lobao et al. study (1990) provided little evidence on industrial restructuring's effect on income distribution patterns because this study did not cover the 1980s, where the pattern of economic restructuring had undergone radical change.

be driven by wide variability in earnings within most sectors, especially those sectors with more highly skilled or highly educated workers.

Various disciplines have contributed to the understanding of the relationship between economic progress and income distribution. Specifically, regional science and development economics have long accumulated evidence toward the theoretical and empirical understandings of this relationship. However, regional scientists and development economists have not paid systematic attention to the effect of the changing nature of economic structure on income distribution.

Newhouse (1971) hypothesized that industry mix could predict differences in the shapes of income distribution across regions. He examined the correlation between 31 sectoral employment shares and 15 income classes. His findings supported a hypothesis that industry mix strongly affected the distributive pattern of income.

Several early studies (Thompson 1965; Murray 1969, 1971) examined the effects of specific sectors on income distribution rather than the effects of overall industrial structure on a regional economy. These studies simply evaluated either the equalizing or the disequalizing effects of employment change or shares in specific sectors, especially in the manufacturing and service sectors. This research tradition has persisted in several sub-disciplines such as urban economics, labor economics, and regional science.

Urban economists have been interested in the distribution of income in urban contexts. They have examined the urban hierarchy-equality hypothesis, an inverse relationship between city size and income inequality (Richardson 1973). Their studies have indicated that income level, industrial mix, and racial composition were important determinants of income inequality as

measured by the Gini coefficient (Long et al. 1977). Certainly, urban economists have been aware that industrial structure might have a direct impact on economic well-being.

Most studies by urban economists measured industrial structure as the percentage employed in manufacturing. Because skill distribution is more homogeneous in the manufacturing sector than in the primary or tertiary sectors and because of the high degree of unionism in the manufacturing sector, the manufacturing employment share is assumed to be associated with income distribution (Danziger 1976; Long et al. 1977; Garofalo and Fogarty 1979; Galster 1989; Cloutier 1997). These studies consistently found that the manufacturing sector was negatively associated with income inequality.

Several labor market studies evaluated the effects of industrial change on wage inequality. These studies tended to confirm the belief that the declining share of "good jobs" has made income distribution more unequal. Most of the studies measured good jobs by the share of employment in some subset of manufacturing (Bound and Holzer 1993; Borjas and Ramey 1994; Juhn 1994; Karoly and Klerman 1994). They showed that the employment share of manufacturing associated positively with economic outcomes (Bartik 1996).

Other studies found that industrial structure influenced income inequality only slightly. Bartik (1996) examined the effects of the shifts in local industrial structure on income inequality using the manufacturing employment share as a proxy for industrial mix. In this study, he failed to find an association of the manufacturing employment share with income inequality. Bound and Johnson (1992) likewise found that industry structure had little effect on inequality.

Regional scientists have analyzed the recent trend of increasing income inequality and its regional variations. They have evaluated the relationship between regional economic growth and

income distribution with the demographic, social, educational, and economic characteristics of different spatial units such as states, regions, or metro/nonmetropolitan counties.

Levernier et al. (1995, 1998a, 1998b, 2000) extensively traced the regional variations of family income inequality with a variety of inequality measures and explanatory variables. All of these studies used key industry employment shares to control for the differences in industrial composition across the spatial units they studied. Their model specifications allowed examination of the effects of specific industrial sectors on income inequality. In general, their studies found that manufacturing jobs were equalizing, while service jobs had mixed effects on income inequality.

Ngarambé et al. (1998) investigated the causal relationship between economic growth and changes in income inequality for the U.S. South in the 1970s and 1980s using Gini coefficients for county-level, real family income. While most studies used employment shares of the manufacturing sector or of major industrial sectors as a proxy for industrial structure, Ngarambé et al. (1998) employed the earnings of nine sectors (agricultural service, forestry, and fishing; mining; construction; manufacturing; transportation and public utilities; wholesale trade; retail trade; F.I.R.E; and services). Results of this study suggested that there was no statistical significance for manufacturing earnings as an explanation for changes in income inequality.

Leatherman and Marcouiller (1996a) first provided a conceptual and empirical framework for determining income distribution characteristics of various economic sectors at a regional level. Then, Leatherman and Marcouiller (1999) suggested that the existing structure of industries in a region was associated with a given pattern of income distribution. In other words, to the degree that the mix of industries is affected by economic development strategies, the distribution pattern may also change. They argued that "the key to identifying distributional

characteristics of economic sectors [was to first] determine their factor input requirements and [then] track the flow of earned income to regional households based on their ownership of productive factors" (1999, p. 39). They implied that the unique mix of industries of different regions determines structural characteristics in the distribution of income.

In sum, findings regarding the effects of economic structure (or industrial mix or industrial composition) and economic restructuring have not been conclusive. Studies tended to agree that manufacturing employment was associated with income distribution. Studies also suggested that strong unionization and homogenous wage structure in the manufacturing sector might contribute to equalizing income distribution.

On the other hand, studies did not provide clear distributional consequences for the service sector. The studies implied that the distribution effects of service industries were much more complex because the service sector had a wider variation of wage structure, skill requirements, and job stability between professional and personal service industries. Furthermore, the distributive effects of service-related work might differ between urban and rural regions.

To study the relationship between economic structure and income distribution, this dissertation research employs the manufacturing and service sectors as variables for representing economic structure. And as a subset of the service sector, this research also employs the tourism sector because the effects of tourism-related jobs are controversial due to their seasonal, temporary, and low-paying job conditions.

Economic Diversity and Income Inequality

The previous section showed that most previous studies measured economic structure by shares or changes of employment in some subset of either manufacturing or service sectors (Bartik 1996; Tomaskovic-Devey 1987; Nielsone and Alderson 1997; Cloutier 1997; Chevan and Stokes 2000) or by the separate shares in employment of all major sectors (Galster 1989; Levernier et al. 1998a, 1998b; Ngrambé et al. 1998). However, the measurement representing the employment share or changes in the subset of specific sectors may not provide complete information on overall sectoral composition or on true industry mix in a regional economy. Previous studies tended to ignore overall sectoral composition or industrial structure in a region.

Thus, to understand the relationship between economic structure and income distribution, this dissertation research reviewed the literature on generating economic diversity measurements that represent an entire economic structure as well as the literature examining the effects of diversity measurements on economic outcomes.

Regional scientists have made efforts to diversify economic structure to prevent economic fluctuations and to improve economic growth. They have hypothesized that if a region's economy becomes more diversified, the region becomes less sensitive to fluctuations caused by factors outside the region. They have promoted economic diversification as a means for economic stability (Siegel et al. 1994, 1995a, 1995b; Kort 1981, 1991; Wagner and Deller 1998). This diversification strategy has become "conventional wisdom" for policy makers (Attaran 1986; Malizia and Ke 1993).

The diversification hypothesis and the conventional wisdom, however, have not been adequately tested. When tested, empirical evidence has been inconsistent (Attaran 1986; Sherwood-Call 1990; Kort 1991; Wundt 1992; Siegel et al. 1994, 1995b; Malizia and Ke 1993;

Wagner and Deller 1998). Early studies made significant efforts to develop appropriate indices for representing the nature and the extent of regional economic structures. Then, during the 1980s, a series of studies began to examine the diversity effects of economic structure, especially in terms of three different relationships: the diversity-stability relationship, the diversity-growth relationship, and the stability-growth relationship.

Developing Economic Diversity Indices

Numerous early studies contributed to developing, testing, and comparing the different indices. Alternative indices for measuring economic diversification include national average, durable goods employment share, minimum requirements, the ogive method, the entropy index, the portfolio variance method, and the input-output measure (Wagner 2000). Entropy measure is one of the indices most commonly employed in the literature (Attran 1986; Attran and Zwick 1987a, 1987b; Smith and Gibson 1988; Deller and Chicoine 1989; Malizia and Ke 1993).

Hackbart and Anderson (1975) introduced the Shannon entropy function into regional economics as a diversity measure. The entropy index defines perfect diversification as equally distributed employment among sectors. Thus, a higher entropy value indicates greater relative diversification, while a lower value implies less relative diversification, or greater relative specialization (Kort 1981; Smith and Gibson 1988).

The entropy index, however, has several limitations. Conroy (1975) pointed out that there was no prior reason to expect that a region should contain an equal distribution of employment across all industries. Wasylenko and Erickson (1978) found that the entropy measure could not explain several highly specialized college towns and state capitals that

actually were relatively stable. Wagner and Deller (1998) argued that the entropy measure did not take into account any inter-industry linkage.

The perceived advantage of the entropy measure is not in its application to evaluate the regional response to exogenously generated business cycles but in its attempt to provide reference points for an equilibrium state of perfect diversity, where concern is focused on the variety of sectors, rather than on the types of sectors. Thus, the entropy measure of sectoral employment distribution can be utilized to picture a regional composition at a given point in time (Siegel et al. 1995a).

The Diversity-Stability Relationship

Early studies on the diversity-stability relationship were inconsistent in their findings. Both Conroy (1975) and Kort (1981), in their comparisons of different diversity measures, concluded that the selected diversity measures were significantly related to observed instability indices. Jackson (1984) failed to find an evident relationship between diversity and stability. Attaran (1986) could not support the hypothesis that diversified areas were more stable than specialized ones.

Consensus has evolved on the diversity-stability relation since the 1980s (Brewer 1985; Brewer and Moomaw 1985, 1986). Attaran and Zwick (1987a) found a weak but significant negative relationship between the entropy diversity measure and unemployment level, implying that diversified counties in Oregon were more stable in terms of unemployment than were specialized counties during the 1972-1981 period. Smith and Gibson (1988) tested the diversity-stability relationship for forty-three primarily resource-dependent rural counties in Idaho and

concluded that in general, economic diversification in small, largely resource-based rural economies might lead to greater cyclical stability.

Deller and Chicoine (1989) examined the relationship between economic diversity and stability for the rural counties in Illinois using an entropy diversification measure. They found that economic activity was stronger in rural areas with diversified income sources. They suggested that diversification could be an optimal overall policy in order to maximize economic activity. While evaluating different diversity measures, Wundt (1992) found that increased specialization increased cyclical instability. Sherwood-Call (1990) also found a strong correlation between diversity and regional volatility. Malizia and Ke (1993) showed that more diversified metropolitan regions experienced lower unemployment rates and less instability than areas that were less diverse. Overall, recent studies suggest that more diverse economies are more stable.

The Diversity-Growth Relationship

Several scholars have examined the relationship between diversity and growth in a regional context. Garcia-Mila and McGuire (1993) argued that the difference in the growth and variability of regional economies in the U.S. could be explained by differences in industrial mix. They concluded that the industrial composition of an economy might exert an influence on regional economic performances. They (Garcia-Mila and McGuire 1994, 1998) also argued that due to knowledge spillovers and agglomeration economies across specific industries rather than within one same industry, certain industrial compositions might be more or less beneficial for growth than other compositions.

Glaeser et al. (1992) employed a data set on several large U.S. cities to test various theories of economic growth such as knowledge spillover within the same industry or across different industries. Using a concentration index, this study showed that industries located in a highly diversified city grew much faster than those in a specialized city economy and found that urban diversity was positively related to later growth. The finding of Glaeser et al. (1992) suggested that cross-fertilization of ideas across different industries stimulated economic growth. Harrison et al. (1996) also argued that innovation and economic growth were much more strongly related with diversity than with specialization. These findings endorsed the diversification strategy (external economies of urbanization) through import substitution as suggested by Jane Jacobs (1968) but they disagree with the specialization strategy (economies of localization) proposed by Romer (1986) and Porter (1990).[4] In sum, previous studies have suggested that a diversified economic structure tended to exhibit a positive effect on economic growth.

The Stability - Growth Relationship

The trade-off between diversity and growth has been examined as another aspect of the diversity–stability relationship. The concept of comparative advantage suggests that growth requires specialization, which is opposite to the strategy of economic diversification. Gilchrist

[4] Economies of agglomeration derive specifically from the local concentration of a particular industry or from the general diversity and size of the local economy. The former is known as "localization economies; the latter is called "economies of urbanization" (Heilbrun 1987; Henderson 1994). A firm can enjoy "localization economies" when it locates near its suppliers or in proximity to other firms of the same industry in a city where a large pool of specialized labor is available. Economies of urbanization occur in metropolitan areas where firms or industries can enjoy larger market demand, the diverse skills of labor force, and the higher potentials of innovation activities (Maki and Lichty 2000).

and St. Louis (1991) suggested that stability through a diversification away from regional comparative advantage might be undesirable. Wundt and Martin (1993) showed that fast employment growth could increase cyclical instability. Lande (1994) identified the trade-offs between employment growth and instability at national and state levels.

On the other hand, other studies suggested the possibility of a complementary relationship between economic stability and growth. While arguing that regions might be able to improve the stability of their economies by diversifying them, Sherwood-Call (1990, p. 24) suggested that "regions may pursue other economic goals, such as rapid growth ... in addition to seeking economic stability." Wagner and Deller (1998) also suggested that the simultaneous pursuit of both growth and stability might not be a trade-off in the context of either the short or the long run. They argued that growth-oriented policy could be implemented in the short-run while diversified development could be implemented in the long-run. Examining the relationship between two types of externalities – localization and urbanization externalities – and industrial development within a dynamic framework, Henderson (1994) found that the effects of the two externalities tended to persist over time. He showed that increased specialization in an industry might have impacts for the next five years but that the effect of diversity measures was likely to persist beyond the six-year horizon. Thus, Henderson's empirical evidence seems to be consistent with Wagner and Deller's (1998) theoretical framework.

In sum, regional scientists have shown that a diversification strategy might not only enhance economic stability but might also promote the other economic goals of employment growth and low unemployment levels (Attaran 1986; Malizia and Ke 1993). The literature on economic diversity, however, has paid little attention to another aspect of economic development,

the effects of economic diversity on regional income distribution. Thus, this research is interested in the effects of economic diversity on regional income distribution.

Tourism Development and Income Inequality

Since the 1970s, rural regions have endured challenges such as economic restructuring and the farm crisis. As a result, alternative economic strategies have been developed for rural regions. Some rural regions have employed tourism as an important component of economic development strategies (Jakus et al. 1995). Good highway systems, increases in leisure time and disposable income, and enhanced environmental awareness have made tourism a feasible economic development alternative for rural regions that have limited economic bases (Flora and Flora 1988; William and Shaw 1988; Marcouiller and Deller 1996).

Tourism development has been recognized as having significant effects on local and regional economies. With an input-out model based on surveys of recreational spending at some state parks of the five southern states, Bergstrom et al. (1990a, 1990b) found that recreational spending contributed substantially to income and employment growth. Cordell et al. (1992) also suggested that state park visits might significantly stimulate economic growth and improve stability, especially in rural regions. English et al. (2000) found that tourism could stimulate growths of population, jobs, income, and housing development. Marcouiller and Mace (1999) and Chappelle (1997) reported substantial effects of tourism development in the Great Lakes region of the U.S.

The economic effects of tourism development, however, need more careful and thorough assessment (Williams and Shaw 1988; Marcouiller and Green 2000). Although tourism and recreational development can help diversify a regional economic base (Johnson and Moore 1993),

they may not be able to avoid short-run employment instability when regions depend primarily on tourism and recreation to uphold economic viability (Keith et al. 1996). Aggregate tourism jobs and income generation may not reflect the costs of community's social well-being (Tooman 1997). Unfettered tourism and recreational development can lead to encroachment on farmlands, incompatibility with the forestry industry, forest fragmentation, environmental degradation, interest conflicts between newcomers and long-term residents, and break-downs of traditional social networks (Romeril 1989; Rudzitis 1999; Perdue et al. 1987; Weaver and Lawton 2001; Lankford 1994; Huang and Stewart 1996; Marcouiller et al. 2002). Ashworth (1992, p. 325) claimed that "the tourism industry clearly still believes its own promises, but has become reluctantly and slowly aware that ... almost everyone else has growing doubts" of the effects of tourism and recreation development.

Although the effects of tourism development have been examined with aggregate measures such as jobs created and income generated (Kottke 1988; Fletcher 1989; Johnson and Moore 1993), there is growing concern about job quality and income distribution of tourism development in rural regions. While it is relatively labor-intensive, the tourism sector generally provides poor quality jobs that are usually temporary, seasonal, or part-time, with fewer benefits and low levels of training (Williams and Shaw 1988; Frederick 1993). Ashworth (1992) argued that tourism has led to the general exploitation of the poor by the rich. Smith (1989) claimed that the low-paying tourism jobs on which many rural women were dependent might not allow them to escape persistent poverty. The distributional consequences of tourism development, however, have not yet been incorporated into an integrated tourism development planning and evaluation process (Marcouiller 1997).

Several methods have been suggested and efforts have been made to measure the distributional consequences of development alternatives (Pyatt and Round 1985; Kottke 1988; Fletcher 1989; Alavalapati and Adamoicz 2000; Wagner 1997; Zhou et al. 1997). For example, Leatherman and Marcouiller (1996a) used social accounting matrix model to evaluate the distributional effects of tourism development as one of five economic development alternatives in a rural region of southwestern Wisconsin. They (Leatherman and Marcouiller 1996a) showed that tourism development primarily affected high-income and low-income households, and exhibited a general hollowing out of the middle-income categories. These results support the arguments of Ashworth (1992) and Smith (1989).

Natural Amenities and Income Inequality

It is well documented that natural resources have experienced a shift in their values from use-related extractive commodities to environmental amenities (Gottlieb 1994; Hays 1998; Marcouiller and Deller 1996). Natural amenities[5] can be considered as a comparative advantage of certain rural regions (Galston and Baehler 1995; Isserman 2001). Many natural amenity-rich communities take advantage of their natural endowments as latent primary factor inputs for tourism or recreational development (Marcouiller and Deller 1996; Marcouiller 1998). Natural amenities, as a quality-of-life factor, are believed to play a critical role in human migration and

[5] The definitions of natural amenities remain unresolved and most previous studies have defined natural amenities in an ad-hoc fashion. For example, Nord and Cromartie (1997) focused on climatic characteristics; McGranahan (1999) referred to climate, topography, and water area; and Isserman (2001) included natural areas, outdoor recreation, broad vistas, and peaceful sunsets. Natural amenities can be region-specific characteristics directly associated with land and water resources. Typically, natural amenities evolved around aesthetics associated with forests and open space, water (lakes, rivers, and coastline), topography (mountains, canyons, and hills), and climates (Marcouiller et al. 2002).

in firm location decision-makings (Dissart and Deller 2000). Only recently have efforts been made to evaluate the effects of natural amenities on economic development.

Early studies examined the effects of location-specific amenities on housing location decisions and individual welfare. Graves (1979, 1980, 1983) and Knapp and Graves (1989) found that location-specific amenities such as climate were significant in explaining population migration. Roback (1982) found that local amenities affected not only land prices but also local wages and housing rents. Roback (1988) also found that differences in amenities generated both wage and rent differentials across regions and implied that some people might enjoy local amenities at the expense of higher rents and lower wages. Porell (1982) showed that both economic and amenity factors were important determinants of migration. Hoehn et al. (1987) found statistical differences in housing prices and wages due to location-specific amenities. These early studies, however, measured amenities mainly with climate (sunshine, precipitation, humidity, or heating/cooling days), urban conditions (crime rates, school quality, or congestion), and environment qualities (the level of particulates, visibility, water pollution discharges, landfill waste amounts, or the number of hazardous waste sites).

On the other hand, recent studies have directly focused on the effects of natural amenities on migration and economic conditions. For example, Rudzitis and Johansen (1991) suggested that the presence of wilderness was an important reason why people moved to or lived near wilderness counties. Several studies have shown that natural amenities were a strong factor in drawing people to rural regions (Nord and Cromartie 1997; Beale and Johnson 1998; Rudzitis 1999).

Other studies of natural amenities, however, have implied that natural amenities might not have strong effects on population and economic growth. Keith and Fawson (1995) examined

the economic effects of wilderness on local economy in Utah. They found that the economic contribution of wilderness was not likely to be significant to a local economy. Duffy-Deno (1997) analyzed the local economic impact of state parks in the eight-state intermountain West and found a relatively weak effect on population and employment growth. Nor did Duffy-Deno (1998) find an association between the existence of federally-owned wilderness areas and population and employment growth between 1980 and 1990.

The effects of natural amenities on regional economies are not yet well understood. A fundamental reason for this lack of understanding is that natural amenities, which are non-market goods, serve as latent primary inputs to the production process of regional economies such as tourism (Marcouiller 1998). Non-market natural amenities are usually not accounted for in current methods of regional economic analysis framework (Marcouiller and Deller 1996). Another reason for this lack of understanding is that efforts to link natural amenities to economic growth and development are not yet systematic, especially in terms of methods for measuring amenity attributes across regions (Gottlieb 1994; Henry et al. 1997; English et al. 2000; Deller et al. 2001).

Two approaches to measuring regional natural amenity attributes are evolving: a composite single index approach and an aggregate factor approach. The composite single index approach is an effort to define natural amenities as a summary index of different natural amenity attributes. This approach is not free from criticism. First, using a single index to represent the heterogeneous nature of natural amenity attributes is ad-hoc. Second, decisions on which amenity attributes should be incorporated to develop a single index can be quite subjective and biased. Finally, this single index approach does not have strong theoretical evidence on the methods for producing a single index.

The aggregate factor approach is an effort to reduce a wide array of natural amenity attributes and to combine them into similar amenity groups. Factor analysis and principal component analysis are employed to produce smaller sets of factors (or principal components) that later are used in regression analysis. This approach is less subjective than the single index approach. One of the problems of this approach is that the final measures (factor scores or principal components) may not be easy to interpret. This approach, however, is useful for this research because it allows examination of multi-dimensional aspects of natural amenity attributes.

Single Index Approach to Natural Amenities

Recent empirical studies have measured natural amenity attributes and have evaluated their economic impacts in regional economies by employing either of these two approaches. The Economic Research Service of the USDA produced a summary index to capture natural amenities in rural counties. This single index consisted of mild sunny winters, moderate summers with low humidity, varied topography, mountains, and the abundance of water. The amenity index was highly associated with net inmigration to rural counties in the early 1990s (Nord and Cromartie 1997). McGranahan (1999) also took the single index approach to generate a single index with six amenity measures: average January temperature, average January days of sun, low winter-summer temperature gap, low average July humidity, topographic variation, and water area. He found that his natural amenities index was highly related to population and employment growth in U.S. nonmetropolitan counties.

Aggregate Factor Approach to Natural Amenities

Three recent studies evaluated the economic impacts of natural amenity attributes using the aggregate factor approach. Henry et al. (1997) used factor analysis to produce two aggregated amenity sets out of twelve local amenities and found that amenity-rich rural areas were more likely to enjoy positive effects from urban centers. Meanwhile, the lower amenity rural areas tended to lose economic opportunities to nearby urban centers. English et al. (2000) used principal component analysis to create four sets of amenity variables: urban resources, land resources, winter resources, and water resources. Later, these variables were employed to evaluate the natural amenity-based tourism dependency of nonmetropolitan counties. English et al. (2000) found that population, employment, income, and housing development grew faster in amenity-based tourism-dependent counties during the 1980s.[6] Also using principal component analysis, Deller et al. (2001) examined the economic effects of five amenity measures: climate, urban facilities, land, water, and winter amenity attributes. They found that counties with higher natural amenity endowments experienced higher overall growth in terms of population, income, and employment.

Although these recent studies have shown that natural amenities, as a growth engine, could play a significant role in economic development of some regions, they have not provided clear implications of the effects of natural amenities on income distribution in a regional economy. Many have been interested in the distributional consequences of natural amenities (Marcouiller and Deller 1996; Marcouiller 1997; Marcouiller and Green 2000; English et al.

[6] English et al. (2000) failed to find statistical differences in income inequality, measured by Gini coefficient, between natural amenity-based tourism-dependent counties and other rural counties and thus suggested further work in potential equity disparities between tourism-dependent counties and nondependent counties.

2000). The distributional effects of natural amenities are an important economic development aspect, especially in rural regions that have suffered from persistent poverty, unemployment and underemployment, and a lack of financial and human capital development.

Without careful consideration of distributional effects, economic development of resource-based regions may cause unintended consequences on the economic and social well-being of communities and people. This dissertation research takes the aggregate factor approach to measure natural amenity attributes and employs them as endogenous growth engines into the endogenous growth framework specified in Chapter 3.

CHAPTER 3

CONCEPTS, METHODS, AND DATA

Alternative Approaches to Regional Income Distribution

The goal of this research is to study the relationship between economic structure and income distribution and, specifically, to determine the income distribution characteristics of economic development alternatives. There are several alternative regional modeling approaches to identifying the distributional patterns of economic sectors. These include Input-output (I-O) analysis, social accounting matrix analysis (SAM), computable general equilibrium (CGE) analysis, and an econometric approach.

I-O analysis traces economic flows between production and consumption activities. However, conventional I-O models focus on the production sector (Adelman and Robinson 1986) and do not deal with household distribution of income and wealth (Keuning and de Ruijter 1988). SAM analysis tracks the complete flow of regional income and expenditure from production sectors to households. Thus, SAM analysis is the appropriate tool for measuring distributional impacts associated with changes in various economic sectors (Leatherman and Marcouiller 1999). CGE models, usually embedded in a neoclassical framework, analyze "the extent to which an exogenous change in one sector affects levels of activity throughout the economy" (Kraybill 1993, p. 199). Thus, CGE models can be defined as a "multi-sectoral supply and demand model with prices being computed endogenously to clear markets" (Clarete and Roumasset 1986, p. 1213). CGE models provide the optimal solution set of economic development alternatives.

These regional modeling techniques have some critical limitations. I-O and SAM models share the limiting assumptions of 1) fixed technology, 2) no substitution of factor inputs, 3) no supply constraints, and 4) no price effects. The models are based on partial equilibrium and optimization (West 1995). CGE models are free from the limitations of I-O and SAM models. However, some drawbacks are that CGE models assume optimizing behavior and the existence of an equilibrium state of an economy (Rose 1995). Critically, sensitivity analyses are often performed due to the uncertainty of parameters of CGE models. Sensitivity analysis cannot guarantee the robustness of CGE results (Partridge and Rickman 1998) because the selection of the parameter values of functions can be very subjective (Abdelkhalek and Dufour 1998).

In addition, all three of these models are aspatial because they cannot capture distinct spatial characteristics of regions. Differing human and natural resource endowments as well as social and institutional arrangements across regions can affect economic activities and income distribution. Furthermore, these types of models track the flows of income and expenditure that are transacted only in markets and therefore, fail to capture the latent inputs and outputs of regional industrial activity. The models, thus, cannot incorporate non-market values associated with such as natural amenities. Finally, the outcomes of I-O, SAM, and CGE models cannot be tested statistically for their significance.

In several ways, an econometric approach can serve the goal of this research which is to find the relationship between economic structure and income distribution in a regional economy. An econometric approach allows evaluation of the statistical significance of variables specified in a model. Econometric models can control for variations in demographics, socioeconomics, and institutions across regions. Econometric models incorporate not only economic variables but also other important variables that may affect regional economic activities.

Conceptual Relationship and Testable Hypotheses

This research estimates income inequality as a function of three groups of factors: economic structure, endogenous growth engines, and natural amenities. The section begins with a discussion of the conceptual relationship between income inequality and selected factors. Based on previous theoretical and empirical work, this research identifies the conceptual relationship and develops a set of testable hypotheses. The expected effects of selected factors on income inequality are discussed.

Economic Structure Variables

The shift in economic structure from manufacturing to services gets blamed as a primary cause of increasing income inequality (Bluestone and Harrison 1982; Glickman 1996; Nielsen and Alderson 1997; Lobao et al. 1999; Morris and Western 1999; Chevan and Stokes 2000). This research hypothesizes that economic restructuring increases income inequality. The hypothesis argues that manufacturing jobs provide good wages for relatively unskilled workers. In addition, high levels of productivity, strong unionization, and narrow wage variations also contribute to equal income distribution. Meanwhile, there is debate on the role and potential contribution of the service sector in a regional economy (Smith 1993-2). Specifically, the service sector exhibits wide variation in job and wage structures, ranging from high-skilled professional jobs to low-skilled, temporary, or part-time jobs. Then, this research assumes that manufacturing jobs have income equalizing effects while service jobs have disequalizing effects.

H_1: Manufacturing employment decreases income inequality.

H_2: Service employment increases income inequality.

This research examines the tourism sector, as a subset of the service sector, to determine its effects on income inequality. While tourism continues to grow and currently contributes significantly to regional economies, the distributional characteristics of the tourism sector in regional contexts remain untested. Few studies have assessed the relationship between tourism development and income distribution (Marcouiller 1997, p. 348; English et al. 2000, p. 196).

There are conflicting perspectives on the effects of tourism as an economic development strategy. Proponents argue that tourism development stimulates new businesses, creates jobs, and increases tax revenues. Tourism is also seen as an environment-friendly industry requiring few public services. Critics hold that tourism provides mostly low-skilled, female-oriented, low-paying, seasonal, and dead-end jobs (Smith 1989; Gibson 1993; Willits 1993; Luloff et al. 1994; Frederick 1993; Marcouiller 1997). This research, however, hypothesizes that although tourism development may produce certain desirable effects, the effects may not be equitably distributed.

H_3: Tourism employment increases income inequality.

The employment of manufacturing, service, and tourism industries as variables allows examination of sector-specific effects on income distributions. This is the direction that most empirical studies have taken. These studies, however, have not considered the characteristics or profiles of an entire economy of a region in their analyses of income distribution. This research employs an economic diversity index to capture the characteristics of an entire regional economy and examines the effects of economic diversity on income distribution.

Economic diversification has been sought as a means to economic stability. Some studies have shown that a diversified economy tends to be more stable (Wundt 1992; Sherwood-Call 1990; Malizia and Ke 1993). Others found that a diversified economic structure was likely to

grow faster (Glaeser et al. 1992; Glaeser 1994; Garcia-Mila and McGuire 1993, 1994, 1998). However, the literature does not provide the distributional implications of a diversified economy.

An economy with diverse economic bases can provide a wide range of jobs and income opportunities for households. A diverse economy can also absorb any external shocks that might have detrimental effects on income distribution. Thus, this research hypothesizes that a diverse economy has an equalizing effect on income distribution.

H_4: Economic diversity decreases income inequality.

Endogenous Growth Engines

Endogenous growth theory emphasizes market size, human capital stock, and public policies for technology innovation and transfer. Endogenous growth models hypothesize that market size should be sufficiently large. If market size increases, the potential of innovation increases. This research hypothesizes that monopoly rents from innovation tends to be concentrated disproportionately to people who have inventive ideas and capital, leading to increase income inequality. This research employs employment density to measure market size because employed people are assumed to participate actively in innovation, production, and consumption activities.

H_5: Employment density increases income inequality.

This research assumes that technical innovation is most likely to be present and manifest itself after individuals have accumulated their knowledge and skill beyond a threshold of

education. This research differentiates human capital into two subgroups: unskilled human capital and skilled human capital (Romer 1990; Grossman and Helpman 1994). Unskilled human capital is assumed to be devoted to final good production sector, while skilled human capital to be devoted to knowledge production or R&D sector. Morris and Western (1999) showed that recent economic restructuring to information technology might decrease education premium of high school education and increase that of college education. This may indicate that new U.S. economic structure has allowed increasing returns to investment in human capital improvement. Thus, growth in both unskilled and skilled human capital can help explain in part the observed increases in income inequality for the last two decades in the U.S.

H_6: Unskilled human capital increases income inequality.

H_7: Skilled and skilled human capital increases income inequality.

Endogenous growth models suggest that public policies or government intervention can play a positive role for economic growth. The models tend to focus on the roles of federal or state governments in providing R&D subsidies, intellectual property rights, and public infrastructure. The models do not provide implications of the functions of regional or local governments in innovation and productivity improvement.

This research is interested in the distributional effects of public investment that local governments make and distinguishes local government expenditures, as a proxy for public investment, into direct and indirect productive expenditures (Barro 1990; 2000b). The direct productive investment is assumed to be devoted to transportation, communication, water, electric power, so on, that directly contribute to productivity growth. The indirect productive investment

is assumed to focus on improving the quality of public education and providing better opportunities of training and learning. This research assumes that if both productive investments of local governments play a role to create favorable economic environments for knowledge accumulation as well as general production activities, endogenous growth process may distribute economic benefits disproportionately to small portion of local households who can take advantage of newly provided public investment, leading to income inequality.

H_8: Direct productive expenditures increase income inequality.

H_9: Indirect productive expenditures increase income inequality.

Natural Amenities as a Growth Engine

One of the major themes of endogenous growth models is the emphasis on human capital (Ehrlich 1990). However, there is agreement that investment in human capital (accumulation) alone is not a sufficient condition to induce local economic development (Stough 1998, p. 4; Temple 1999, p. 139). Endogenous growth models tend to underestimate the potentials of lagging regions and communities to produce growth through their lower cost advantages or through their specific endogenous natural resources. It is widely recognized that the so-called "rural renaissance" of the 1970s was possible due to cheap land, low-cost infrastructure, and low-cost labor in rural regions (Flora and Christenson 1991). In addition, new findings of coal or oil reserves have historically led lagging areas to economic growth (Suarez-Villa and Cuadrado Roura 1993).

Natural resources have been a source of both raw material and value added in many regions. Recently, natural resources have received much attention as non-market based

environmental and amenity values and have become a promising growth engine for some regions (Marcouiller and Deller 1996; Marcouiller 1998; McGranahan 1999; Dissart and Deller 2000; English et al. 2000; Deller et al. 2001). Isserman (2001) viewed natural amenities in the rural U.S. as a source of competitive advantages that could create new economic opportunities in the twenty-first century:

> [R]ural America has numerous competitive advantages. It offers its own amenities – natural areas, outdoor recreation, broad vistas, peaceful sunsets, and what might be called AMENities – freedom from congestion, crime, commuting, pollution, change, diversity, and the conflicts of urban life. It also offers lower land costs, lower building costs, lower housing prices, lower labor costs, lower security costs, lower parking costs, and lower taxes. (Isserman 2001, p. 45)

Several empirical studies have evaluated the effects of natural amenities on regional economic performance. Results suggest that natural amenities affected regional economies through aggregate measures of economic performance such as population growth, income growth, employment growth, and housing development (McGranahan 1999; English et al. 2000; Deller et al. 2001). Assessing the developmental aspects of amenity-led regional changes, however, requires a more thorough focus on alternative measures of economic performance such as income distribution.

This research assumes that natural amenities can provide new economic development opportunities for some regions. Specifically, natural amenities can play a role as a latent primary factor input to the tourism and recreation sector. Although they can contribute to generating jobs, those jobs may be seasonal, temporary, part-time, and low skilled. Newly generated income can be best suited as supplemental income and may not be equitably distributed. This research hypothesizes that natural amenities have disequalizing effects. This research also hypothesizes

that different types of natural amenities have different distributional effects. Thus, the distributional effects of natural amenity must be evaluated with multiple natural amenities.

H_7: Natural amenities increase income inequality.

Model Specifications and Estimation Methods

Empirical Model Specifications

As stated earlier, this research hypothesizes that three groups of factors are affecting regional income inequality: economic structure, endogenous growth engines, and natural amenities. To test the relationship between economic structure and income inequality within an extended endogenous growth framework including natural amenity variables, two empirical models are specified:

(3.1) Static Model: $\boldsymbol{Gini}_i = \beta_0 + \beta_1 \boldsymbol{E}_i^{\boldsymbol{k}} + \beta_{2i} \boldsymbol{G}_i^{\boldsymbol{m}} + \beta_{3i} \boldsymbol{A}_i^{\boldsymbol{n}} + \varepsilon_i$

(3.2) Change Model: $\Delta \boldsymbol{Gini}_i = \beta_0 + \beta_1 \Delta \boldsymbol{E}_i^{\boldsymbol{k}} + \beta_{2i} \Delta \boldsymbol{G}_i^{\boldsymbol{m}} + \beta_{3i} \boldsymbol{A}_i^{\boldsymbol{n}} + \varepsilon_i$

where β = the coefficients to be estimated,
Δ = change between 1980 and 1990,
E = a vector of economic structure variables,
k = the index of manufacturing employment, retail/service employment, tourism employment, and diversity indices, respectively or together,
G = a vector of endogenous growth variables,
m = the index of density, education, and expenditure variables, respectively or together,
A = a vector of natural amenity group variables,
n = land, river, lake, warm weather-based, and cold weather-based amenity variables,
i = county (i =1, ..., 242), and
ε = error term.

The "static model" estimates the static relationship between independent and dependent variables in terms of level in 1980 and in 1990 while the "change model" estimates the difference between 1980 and 1990. The change model is based on the assumption that natural amenities, denoted as vector A, have not changed between 1980 and 1990 because decadal data for natural amenities are not available. However, this assumption may be valid because of the distinct characteristics of natural amenities. Natural amenities may not be able to be produced or redeveloped in a short time. If destroyed or degraded, they may not be easily substituted because they are unique in certain regions (Green 2001).

Relative Importance of the Ordinary Least Squares Assumptions

A traditional Ordinary Least Squares (OLS) estimation must meet the following five assumptions: 1) the regression model is linear in the coefficient and the error term, 2) the error term has a zero population mean, 3) all explanatory variables are uncorrelated with the error term, 4) the errors are independent (no serial/spatial correlation) and have a constant variance (no heteroskedasticity), and 5) no explanatory variable is a perfect linear function of any other explanatory variable (no perfect multicollinearity). Thus, in the case that one or more of the classical assumptions were violated, the estimators would not be the *best linear unbiased estimator* (BLUE) and could lead to incorrect policy implications (Kennedy 1998).

For this research, several diagnostics were employed to detect multicollinearity, heteroskedasticity, and serial correlation. Some observations had extreme values. To deal with these outliers, a robust regression approach was employed. Robust regression, an alternative to traditional OLS estimation, corrects for the effects of outliers and produces more conservative estimates of standard errors (Kassab 1990, 1992).

Although all of the OLS assumptions should be met, Griffith and Layne (1999) suggested that the most important assumptions concern the errors that should not be independent and whose variance must be constant. Griffith and Layne (1999) emphasized the statistical significance of the consequences of these two assumptions:

> [V]iolation of any combination of the principal assumptions introduces a specification error into a statistical model and can result in seriously flawed conclusions. The magnitude of corruption introduced into an inferential basis attributable to this specification error leads to the following ranking of importance of these assumptions: (1) constant variance, (2) non-0 spatial autocorrelation, and (3) normality. In fact, with regard to the adverseness of consequences generated by violation of these assumptions, there is a sizeable gap between those arising from non-normality and those arising from variance heterogeneity or spatial autocorrelation. (Griffith and Layne 1999, p. 71)

Of the two important assumptions regarding the errors, this research attended especially to the independence assumption of the errors. Traditional OLS estimation methods cannot control for the dependence of the errors and thus, cannot generate efficient estimates. Inefficient estimates, then, cannot provide correct information on data.

Does Spatial Autocorrelation Matter?

Doreian (1980) argued that data aggregated over politically or administratively well-defined areas contained geographical space and that conventional linear models to estimate the data might lead to methodological problem because "everything is related to everything else, but near things are more related than distant things" (Tobler 1970, p. 236). As a result, Doreian (1981) suggested that the spatial interrelationship of social and economic phenomena should not be overlooked, especially when geographically referenced data were analyzed with conventional estimation methods.

The geographical interdependence of social phenomena can be called "spatial autocorrelation" (Griffith 1987). Spatial autocorrelation, then, can generally be defined as "the coincidence of value similarity with locational similarity" (Anselin and Bera 1998, p. 241). Positive spatial autocorrelation arises when similar values of a random variable tend to cluster in a region and negative spatial autocorrelation occurs when dissimilar values of a random variable are clustered around a specific location. The existence of spatial autocorrelation, and especially of positive spatial autocorrelation, implies that a sample data set may contain less information than an uncorrelated data set.

Spatial autocorrelation can often arise due to a certain misspecification. Political boundaries such as states, counties, or census tracks are often not matched with the economic phenomena under consideration. For example, "census tracts are not housing markets and counties are not labor markets, but they are just used as proxies to record transactions of these markets" (Anselin and Bera 1998, p. 239). The mismatch between political boundaries and functional economic boundaries may result in spatial measurement errors and spatial autocorrelation between these errors in neighboring units (Miron 1984; Anselin and Bera 1998; LeSage 1997).

Empirical studies tend to give little attention to spatial effects. In the presence of spatial interdependence or autocorrelation, a model that does not specifically incorporate spatial effects suffers from misspecification, and is potentially biased, inconsistent, and inefficient (Griffith 1996). Models that exclude spatial effects are incomplete (Loftin and Ward 1983; Gaile and Willmott 1984; LeSage 1997). Doreian (1980, p. 51) argued that "the nonspatial model estimated by conventional regression procedure is not a reliable representation and should be avoided when there is a spatial phenomenon to be analyzed."

Spatial interdependence and interaction often occur in a regional economy where the importance of location and spatial interaction is fundamental (Anselin and Bera 1998; LeSage 1997). Economic activities, especially manufacturing, are spatially concentrated; population is not equally distributed over space; and the geographic distribution of natural amenities is uneven. The economic structure of a county or a state is usually similar to those of its neighboring counties or states because neighboring counties or states actually affect and learn from one other. Similar housing development or distribution patterns across neighboring regions are typical examples of spatial interaction. Income distribution patterns also show spillover effects across neighboring spatial units. For example, a higher-income county is very likely to be adjacent to other higher-income counties. Spatial processes such as spatial interaction, spatial interdependence, or spatial spillover effects are a critical methodological issue that should be incorporated into regional science.

Although regional scientists have long recognized the importance of location and spatial interaction, they have recently come to appreciate the methodological problems of data and estimation methods (LeSage 1997; Anselin and Bera 1998). Regional science is interested in spatial processes that evolve over space. And regional scientists always deal with space-referenced data that contain explicitly or implicitly demographic, social, economic, and geographical information. Specifically, the methodological problems of spatial data depend on the issue of whether or not observations for a variable at one point of geographical space are interdependent with other observations for that variable at other points in geographical space. If there is such spatial interdependence, then traditional OLS estimations become problematic because of the violation of the non-0 spatial autocorrelation. Thus, alternative estimation methods need to be performed.

Detecting Spatial Autocorrelation

The first step in detecting spatial autocorrelation is to explore spatial data with visualization and significant testing. Exploratory Spatial Data Analysis (ESDA) involves describing data to help develop hypotheses and appropriate models. ESDA focuses on the spatial aspects of the data in terms of spatial dependence (spatial association) and spatial heterogeneity. ESDA is especially very useful for the detection of spatial clustering and complete spatial randomness. This research focuses on data mapping, Moran's I statistic of spatial autocorrelation, local indicators of spatial association (LISA), and the Moran scatterplot (Bailey and Gatrell, 1995; Anselin 1996).

Data mapping, a graphical analysis of spatial data, highlights particular spatial features and allows the detection of spatial patterns, relationships, unusual values, and so on. Data mapping is very easily performed with any geographic information system (GIS) software such as ArcView or ArcInfo. However, the visualization of the spatial distribution of a variable does not provide statistical evidence of spatial autocorrelation.

Moran's I statistic is a useful global measure for detecting spatial autocorrelation[1] and is based on a comparison of the values of neighboring spatial units. If neighboring spatial units have similar values over the entire study region, then Moran's I indicates a strong positive spatial autocorrelation. If spatial units have very dissimilar values, Moran's I show a strong negative spatial autocorrelation (Anselin 1988; Lee and Wong 2001). Moran's I can be expressed as follows:

[1] Global spatial autocorrelation refers to the average relationship between value and locational similarity throughout the entire geographic region, while local spatial autocorrelation focuses on each spatial unit and its immediate neighbors.

$$(3.3) \quad I = \frac{n\sum\sum w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{W\sum(x_i - \bar{x})^2}$$

In Equation (3.3), w_{ij}, an element of the spatial weights matrix $\boldsymbol{W}$, is 1 if spatial units i and j share a border and 0 otherwise. The value of spatial unit i is x_i, $\bar{x}$ is the mean of the variable x, and N is the number of observations.

The numerator of Moran's I is based on the product of the deviations of the mean. If the deviations of i and j are above (or below) the mean, the product is a large positive number, indicating the presence of positive spatial autocorrelation. If the product of the two mean deviations is negative, Moran's I indicates negative spatial autocorrelation. Thus, if similar values such as high-high or low-low are more likely than dissimilar values between neighboring units of a region, then Moran's I will be positive. Moran's I asymptotically ranges between –0.6 and +0.6.

Local indicators of spatial association (LISA) provide another method for detecting spatial autocorrelation. Global statistics such as global Moran's I, based on the entire study region, provide only limited information on spatial association because spatial variation is also possible within a region. If the number of observations is very large or if the study region is very large, a single global statistic may not capture disparate spatial distributions within the region. In such cases, it is better to use a local spatial indicator that accounts for spatial variation within a region. That is, local spatial statistics take into account spatial heterogeneity within a region (Getis and Ord 1996; Anselin 1995; Lee and Wong 2001).

Anselin (1995, p. 2) suggests that "a local indicator of spatial association (LISA) is any statistic that satisfies the following two requirements: (a) the LISA for each observation gives an

indication of the extent of significant spatial clustering of similar values around that observation; and (b) the sum of LISAs for all observations is proportional to a global indicator of spatial association." A LISA, thus, can identify the existence of pockets, or 'hot spots,' of spatial autocorrelation.

Local Moran's I, a LISA, is derived for each spatial unit in order to identify spatial autocorrelation at the local level. A high value of local Moran's I indicates a clustering of similar values (either high-high or low-low) and a low value of local Moran's I shows a clustering of dissimilar values (either high-low or low-high).

The Moran scatterplot is a very effective visual diagnostic tool that is based on a regression framework and Moran's I statistics (Anselin 1995, 1996). Moran's I can be interpreted as the degree of linear association between a vector of observed value x and a spatially weighted average of the neighboring values, or spatial lag $\boldsymbol{W}x$. since $(x_i - \bar{x})$ is the deviation from the mean. Thus, Moran's I is equivalent to a regression coefficient in a regression of $\boldsymbol{W}x$ on x. The linear association between x and $\boldsymbol{W}x$ in the form of a bivariate scatterplot of $\boldsymbol{W}x$ against x is a Moran scatterplot. A line can, then, be added to the Moran scatterplot to represent the slope of Moran's I. [2]

A Moran scatterplot can be divided into four quadrants to indicate different types of spatial association between the value of a location x and its spatial lag $\boldsymbol{W}x$. The upper-right and lower-left quadrants represent positive spatial association because high-high and low-low values are associated. The lower-right and upper-left quadrants indicate negative spatial association, because low-high and high-low values are associated.

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[2] Anselin (1996), however, argued that the significance of the slope (R^2) in the Moran scatterplot was not statistically appropriate.

Modeling Spatial Autocorrelation

Spatial autocorrelation usually takes one of two forms (Brown 1996; Anselin and Bera 1998; Kelejian and Prucha 1998). One form of interdependence arises when the value of the dependent variable for each observation depends on the dependent variable's values of its neighbors. The spatially lagged dependent variable is typically correlated with the error term and hence the OLS estimator is typically not consistent in such situations. Thus, a spatial lag model (SLM) is often employed to control for this form of spatial autocorrelation. This SLM incorporates the spatially weighted values of a dependent variable in a regression relationship.

Another form of dependence arises when the value of the error term depends on the value of neighboring error terms. Spatial autocorrelation of the error terms is typically observed in cross-sectional data. This form of spatial autocorrelation is controlled by a spatial error model (SEM). To incorporate spatial autocorrelation into a regression model, an SEM specifies a spatial weight for the error terms.

In examining the relationship between economic structure and income distribution, this research assumed that economic structure and income distribution patterns of neighboring counties implicitly affect one another and that the implicit spatial autocorrelation can arise through the error terms. When regression errors are spatially autocorrelated, the usual variance estimators are severely biased. In such cases, the main problem with using OLS is that the usual standard error estimator tends to underestimate the true standard error. This underestimation affects "levels of statistical significance, and hence the precision of any single set of sample estimates, as well as prediction error" (Griffith 1996, p. 6).

Thus, this research employed an SEM to control for spatially autocorrelated errors. The most common specification for spatial autocorrelation in the error terms is

$$(3.4) \quad \begin{aligned} y &= X \times \beta + u \\ u &= \rho W u + e \end{aligned}$$

where ρ = spatial autocorrelation coefficient,
u = spatially autocorrelated error term,
W = spatial neighborhood weights matrix, and
e = uncorrelated and homoskedastic error term.

In an SEM, the vector y contains cross-sectional observations for counties, the matrix X contains a set of explanatory variables, the vector u is the error term that is spatially autocorrelated, ε is the uncorrelated error vector with $N(0, \sigma^2 I)$, and the vector ρ is the spatial autoregressive coefficient to be estimated for Wu. The parameter ρ in Equation (3.4) indicates the extent to which variation in the vector y is explained by the 'average' of neighboring values (LeSage 1997). An SEM includes an $(n \times n)$ positive and symmetric spatial weights matrix W. W is often expressed as a first-order spatial contiguity matrix that incorporates the values of variables in adjacent geographic areas. The elements w_{ij} of W are 1 when counties i and j are neighbors and 0 when they are not.[3]

This research employed several software packages and programs to perform different analyses. First, the robust regression was estimated with SAS. S+SpatialStat (Kaluzny et al. 1998; MathSoft 2000) and its ArcView extension (MathSoft 1998) were used to estimate the SEM. Moran scatterplots were achieved with an ArcView script provided by Lee and Wong (2001). All maps were created with ArcView GIS (version 3.2a).

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[3] Spatial proximity can be measured in many different ways. An $(n \times n)$ spatial weights matrix is a common approach to measure spatial proximity between spatial entities. A spatial weights matrix is typically constructed based on either by adjacency or by distance (for details, see Bailey and Gatrell 1995, p. 261; Lee and Wong 2001, pp. 137-144).

Data and Measurements

Income Inequality Measure: The Gini Coefficient

The Gini coefficient, as a dependent variable, is used to measure the level and change of income inequality for grouped family income. The analogous graphical representation for the Gini coefficient is a Lorenz curve that represents the relationship between the cumulative percentage of total income within an economy and the cumulative percentage of income received. A hypothetical Lorenz curve is plotted in Figure 3.1. The area between the Lorenz curve and the equality line is Area A, and the area below the Lorenz curve is Area B. With the aide of Figure 3.1, the Gini coefficient can be defined as:

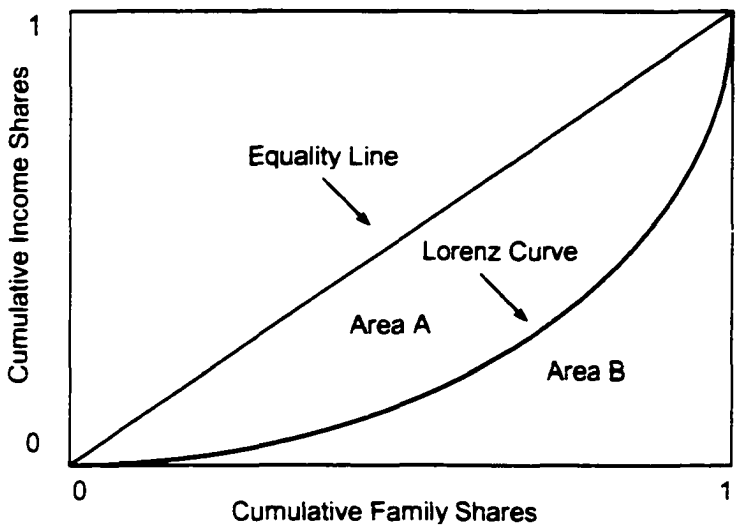
(3.5) ***Gini coefficient = Area A / (Area A + Area B)***

This equation shows that the Gini coefficient yields a scalar from 0, indicating perfect equality, to 1, indicating perfect inequality. The larger the Gini coefficient, the higher income inequality. This research employed Equation (3.6) to obtain the Gini coefficient of the grouped family income at the county level from the U.S. censuses of 1980 and 1990.

$$(3.6) \quad Gini = \frac{\sum_i \sum_j |x_i - x_j|}{2n^2\mu} = \frac{\sum_i \sum_j |y_i - y_j|}{2n}$$

where n is the number of family income categories, μ is the mean of family income categories, x_i is total family income in family income category i ($=j$), and y_i is the income share of family income category i (Kuenne 1993).

Figure 3.1 A Hypothetical Lorenz Curve



There were 17 categories in the family income distribution for 1979 and 25 for 1989. For comparison, the raw distributions as the number of families in various income categories were adjusted into 15 categories for the two periods. The Gini coefficient was calculated by assuming that each family income category was at the midpoint of its income category for the first 14 income categories (Levernier 1998b). This research employed the 1979 level, the 1989 level, and the 1979-1989 change of the Gini coefficient of family income inequality for each county.

Economic Structure Measures

To calculate the levels and the change of employment, several measurements were used in the analysis: manufacturing employment, retail+service employment, tourism-related employment and establishments, and entropy diversity indices for employment and establishment.

Employment data accounted only for private industries. Manufacturing industries and retail+service industries were two-digit Standard Industrial Classification (SIC) codes reported in the Bureau of Economic Analysis's Regional Economic Information System (BEA-REIS, http://fisher.lib.virginia.edu/reis/). The levels and change of manufacturing and retail+service employments were the shares in total private employment in 1980 and 1990 and their percent changes in 1980-1990, respectively.

The tourism sector is easy to define in an intuitive way, but much more difficult to define in a formal sense (Smith 1988). There have been debates in the literature about whether or not tourism is an industry (Smith 1993-1). Furthermore, there have been conflicting views on the definition of tourism: a demand-side view and a supply-side view (Leiper 1979; Smith 1988, 1993-1). The demand-side view attempts to define tourism in terms of who demands tourism

products and of who are tourists, while the supply-side view emphasizes tourism products, rather than consumers (tourists) (Smith 1988, 1993-1). The demand-side perspective defines tourism as "the action and activities of people taking trips to a place or places outside their home communities for any purpose except daily commuting to and from work" (National Tourism Policy Study 1978, p. 5). The key feature of the supply-side perspective is its focus on commodities as tourism-industry products. This perspective defines tourism as "the aggregate of all businesses that directly provide goods or services to facilitate business, pleasure, and leisure activities away from the home environment" (Smith 1988, p. 183).

This research took the supply-side definition of tourism because of the difficulty in obtaining the demand-side measures of the tourism industry. Specifically, this research used the notions of "Tier 1" and "Tier 2" businesses (Smith 1988, p. 184). Tier 1 businesses are those deriving virtually all revenues from tourists and Tier 2 businesses are those deriving revenues from a mix of tourists and non-tourists (Smith 1993-1). Thus, Tier 1 businesses serve only tourists (e.g., airlines, hotels, and travel agents) but Tier 2 businesses serve both tourists and local residents.[4]

Thirty sectors were identified as tourism sectors at the 3-digit SIC level (Table 3.1). These sectors included transportation (charter service, car rentals, and air transportation services), accommodation (including hotels, motels, campgrounds, and inns), eating/drinking (restaurants and bars), retail trade (grocery stores, gas stations, and gift shops), and recreation

[4] It should be noted that a critical problem of the supply-side definition of tourism is that there is no differentiation between local tourism demand and out-of-region tourism demand. Thus, the supply-side definition can exaggerate tourism's contribution to a regional economy. Leatherman and Marcouiller (1996b) and English et al. (2000) used the minimum requirements technique to isolate employment that serves local tourism demand and employment that serves external tourism demand. This research, however, does not employ this technique because this research focuses not on an exact estimation of the tourism sector's economic contribution but on the relationship between the tourism sector and income distribution.

Table 3.1 Tourism-related Sectors at the 3-digit SIC Level

SIC code	Tourism-related Sector
Transportation	
414	Bus charter services
448	Water transportation of passengers
449	Water transportation services
451	Air transportation, scheduled
452	Air transportation, non-scheduled
458	Airports, flying fields, and services
472	Passenger transportation arrangement
474	Rental of railroad cars
478	Miscellaneous transportation services
Retail trade	
541	Grocery stores
554	Gasoline service stations
556	Recreational vehicle dealers
581	Eating and drinking places
591	Drug stores and proprietary stores
592	Liquor stores
594	Miscellaneous shopping goods stores
598	Fuel dealers
599	Retail stores, n.e.c.
Services	
701	Hotels and motels
702	Rooming and boarding houses
703	Camps and recreation vehicle parks
704	Membership-basis organization hotels
721	Laundry, cleaning, and garment services
751	Automotive rentals, no drivers
783	Motion picture theaters
792	Producers, orchestras, entertainers
794	Commercial sports
799	Miscellaneous amusement, recreation services
841	Museums and art galleries
842	Botanical and zoological gardens

Note: SIC codes are based on the 1987 Standard Industrial Classification.

services (ski areas, golf courses, museums, cultural attractions, and amusements parks). This research used the employment share (%) of these thirty sectors as a proxy for the tourism industry.

Tourism-related employment data were obtained from County Business Patterns (CBP) of the U.S. Bureau of the Census. Two different data sources of CBP were employed. One was from the website (http://fisher.lib.virginia.edu/cbp/) and the other from the Inter-University Consortium for Political and Social Research (ICPSR) for 1980 and 1990. There was a problem with tourism-related employment data at the 3-digit SIC level of CBP because much of the data in the tourism sector was not reported that would have disclosed the operation of an individual employer. Thus, a flag rate was calculated. The flag rate was the number of tourism- related sectors that did not report the number of employees divided by the total number of identified tourism-related sectors. Around 95 percent of the tourism-related sectors that did not report their number of employees had very small employment size classes, either from 0-19 or from 20-99. The average flag rates were 55.3 percent for 1980 and 54.5 percent for 1990.

This disclosure problem is very serious because most tourism-related firms were very small. Thus, the number of tourism-related establishments, as another tourism industry measure, was employed in the analysis because the number of establishments did not have this disclosure problem. The levels and change of tourism-related employment and establishments were the shares of total employment and of total establishments in 1980 and 1990 and the percent change of the shares from 1980 to 1990, respectively.

The final economic structure measures were two entropy diversity indices. As stated in Chapter 3, an entropy diversity index is a measure of the breadth of regional economic activity. It provides a reference for the equilibrium state of economic diversity at a given time. This

research assessed the extent of economic diversity in the research region in 1980 and in 1990. That is, this research examined the entropy index as a static measure of diversity across counties but did not explicitly evaluate the benefit that a particular county would gain from diversifying its own economy (Sherwood-Call 1990).

The research calculated two entropy indices using the number of workers and the number of establishments of sixty-nine sectors at the 2-digit SIC level for the 242 counties. The entropy diversity index is equal to zero when a county has one specialized sector and is highest when a county has equal distribution of employment (or establishments) across industries (Kort 1981; Smith and Gibson 1988). These data are obtained from CBP. The two indices were calculated with Equation (3.7).

$$(3.7)\quad \textbf{\textit{Entropy diversity index}} = -\sum_{s=1}^{S}\left(\frac{e_{is}}{e_i}\right)\ln\left(\frac{e_{is}}{e_i}\right)$$

where e_{is} is the employment (or establishments) of industry s in county i; e_i is total employment (or establishments) in county i; and ln denotes natural logarithm. However, since each county did not have all sixty-nine sectors, the entropy diversity indices was standardized by the natural log of the total number of economic sectors present in a county (N).

$$(3.8)\quad \textbf{\textit{Relative entropy diveristy index}} = \frac{\textbf{\textit{Entropy diversity index}}}{\ln(N)} \times 100$$

The natural log of the number of economic sectors present in a county (N) is the maximum theoretical value of the entropy diversity index. Then, the relative entropy diversity index takes on values between 0 and 100 and allows for comparison of the diversity of different counties. The changes of the relative entropy diversity indices were the percent change between 1980 and 1990.

Endogenous Growth Variables

This research focuses the importance of market size, human capital, and public investment as endogenous growth variables. The three endogenous growth variables were measured by employment density, educational attainments, and local government expenditures. Most endogenous growth models employ population density to measure market size. This research used employment density to measure market size. Employment density can measure market size better because it represents employed people who actively participate in production and consumption activities. Employment density was total employment in private sectors that was adjusted by the land area of a county.

This research differentiated human capital into unskilled and skilled by the levels of educational attainment. The former was measured by the proportion of persons above twenty-five years old with a high school degree. The latter was measured by the proportion of persons above twenty-five years old with a four-year college degree and higher.

This research differentiated public investment into direct and indirect public investment. This research measured the direct public investment of local government by the share of highway expenditure in general expenditure of a county government in 1982 and 1992. The indirect

public investment was measured by the share of education expenditure in general expenditure of a county government in 1982 and 1992.

Measures of Natural Amenity Attributes

Natural amenities were employed as an extended growth engine in this research. This research measured multiple amenity variables because different amenity types might have different income distribution effects across various regions. This research used the aggregate factor approach[5] in measuring the natural amenity attributes of each county. To capture the natural attribute characteristics of the study region, this research proposed five groups of natural amenity attributes. (Table 3.2). Five amenity indices were calculated using a principal component analysis (PCA) method that transformed a given set of related variables into a single measure (Kim and Mueller 1978). The final single measure represents the characteristics of the original variables. Although there are several rules for selecting a specific principal component (Griffith and Amrhein 1997, pp. 169-170; Deller et al. 2001), this research used the first principal component method because the first principal component is the best summary of the entire data that accounts for the most total variance in the correlation matrix across all the variables.

The five amenity indices were based on land-based natural amenities, river-based natural amenities, lake-based natural amenities, warm weather-related natural amenities, and cold weather-related natural amenities. Land-based natural amenities were the terrain and open spaces within a county that may be available for outdoor recreation; the final measure

[5] The advantages and disadvantages of the aggregate factor approach were discussed in pages 48 to 50.

Table 3.2 Principal Component Analysis of Five Natural Amenity Groups for the Study Region

Amenity Variables	Variable Description	Eigenvectors
Land-based	**Cumulative variance explained**	**0.2598**
PVTAGAC	Acres of crop/pasture/range land (%)	-0.5548
FSACRE	USDA-FS Forest & Grassland acres (%)	0.4235
NRIFORAC	NRI non-federal forest acres (%)	0.5121
WildLand	NRI non-federal wildlife-reserved land acres in the county (%)	-0.1010
NPL_LAND	Rural land open to public for outdoor recreation	0.1895
RTCTRTM	RTC total rail-trail miles (%)	0.2577
STPARKS	State park acres (%)	0.1235
PKLOC	Local or county parks per 1Kpop	0.2355
ABIPARK	State parks per 1Kpop	0.2562
ISTEA	ISTEA funded greenway trails per 1Kpop	0.0417
River-based	**Cumulative variance explained**	**0.3536**
ABICANO2	Canoe/raft outfit/trip firms per 1Kpop	0.1805
AWAWHITE	AWA white-water river miles per 1K acres	0.3404
WSRIVER	Wild & scenic river miles per 1K acres	0.0549
RUNWATER	River & stream acres (%)	-0.0192
RIVERML	NRI river miles, outstanding value (per 1K acres)	0.5996
RIVRECML	NRI river miles eligible for recreation status (per 1K acres)	0.3555
RIVRVALU	NRI river miles w/ recreation+scenic+wildlife value (per 1K acres)	0.6019
Lake-based	**Cumulative variance explained**	**0.3806**
ABIMARIN	Marinas per 1Kpop	0.3797
ABIFISH2	Fish camps/lakes/piers/ponds per 1Kpop	0.2934
OthWATER	Other water acres of reservoir + bay/gulf + estuary per (%)	-0.0302
LAKEBIG	NRI acres of lake >= 40 in size (%)	0.6085
WATERSML	SUM of small streams and water bodies (%)	0.2008
RECWATER	NRI acres devoted to water-based recreation (%)	0.5986
Warm Weather-based	**Cumulative variance explained**	**0.2116**
ABIPARKD	Parks and recreation departments per 1Kpop	-0.0830
ABITOUR	Tour & sightseeing operators per 1Kpop	0.3843
ABIPLAY2	Playgrounds & recreation centers per 1Kpop	-0.0804
ABISWIM2	Private & public swimming pools per 1Kpop	0.0850
ABITEN2	Private & public tennis courts per 1Kpop	-0.1031
CAMPS	Organized camps per 1Kpop	0.4871
ABIGOLF2	Private & public golf courses per 1Kpop	0.3312
AMUSE	Amusement places per 1Kpop	0.3202
FAIR	Fairgrounds per 1Kpop	-0.0284
CAMPsite	WOODALLS private + public campground sites per 1Kpop	0.4821
ABITATT2	Tourist attractions/historic places per 1Kpop	0.3721
Cold Weather-based	**Cumulative variance explained**	**0.3944**
CCSFIRM2	XC ski firms and public centers (#/1Kpop)	0.4148
ISSSACRE	ISS skiable acreage (%)	0.2146
SNOWLAND	Federal acres in county w/ > 24 in snow (%)	0.3229
SNOWAG	Agricultural acres in county w/ > 24 in snow (%)	-0.3386
SNOWFOR	Forest acres in county w/ > 24 snow (%)	0.2664
SKIINFRA	ABI # skiing centers/resorts + tours + rentals per 1Kpop	0.4577
DOWNSKI	SS # downhill skiing areas per 1Kpop	0.4186
WINTRAIL	Rail line miles converted to trails for winter recreation (%)	0.0988
SNOWMOBL	NPS # units + state park # w/ snowmobiling available per 1Kpop	0.3123

accounted for 26 percent of variance in the land amenity group. River-based natural amenities were river miles eligible for recreational uses or with recreational, scenic, or wildlife values within a county; 35.4 percent of variance in the river amenity groups was explained by the final measure. Lake-based natural amenities consisted of small or big lakes and streams that could be devoted to lake-related recreational activities; the final factor score explained 38 percent of variance in the lake amenity group. Warm weather-related natural amenities were constructed to capture summer recreational opportunities including swimming pools, playgrounds, tennis courts, golf courses, amusement parks, and campsites; only 21 percent of the cumulative variance of the warm weather amenity index was explained. Cold weather-related natural amenities captured winter recreational opportunities and were mainly cross-country skiing- or downhill skiing-related facilities; the final measure explained 39 percent of variation in the cold weather-related amenity index.[6] According to the cumulative variance explained for the five natural amenity groups, the final measures of river-based, lake-based, and cold weather-based amenity groups showed relatively higher performance than the other two groups.

The natural amenity data were from the 1997 National Outdoor Recreational Supply Information System (NORSIS) data set developed and maintained by the USDA Forest Service's Wilderness Assessment Unit, Southern Research Station at Athens, Georgia.

The variable descriptive statistics were summarized in Table 3.3. Income inequality in the region, measured by the Gini income inequality index, changed drastically between 1980 and 1990. The mean of the Gini income inequality index increased from 22.61 in 1980 to 48.96 in 1990. During the decade, income inequality increased 26.35 in the region. Employment density was around 58 persons per square mile in 1980 and 69 person in 1990. During the

[6] Appendix 1 provides the spatial distributions of the five selected natural amenity groups.

Table 3.3 Variable Description and Descriptive Statistics

Name	Description	N	1980 Static		1990 Static		1980-90 Change	
			Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Dependent Variable								
GINI	Gini index (x 100) of 15 family classes in '79 and '89	242	22.611	6.312	48.960	10.255	26.349	9.121
Economic Structure Variables								
MANU	Share of manufacturing employment	242	21.814	10.665	21.062	9.783	1.557	38.662
RSVC	Share of retail + service employment	242	49.818	8.155	52.779	8.567	6.417	8.882
TREMP	Share of tourism-related employment	242	15.068	4.856	15.097	5.356	3.107	32.751
TFIRM	Share of tourism-related establishments	242	22.954	5.681	20.328	4.481	-9.436	21.733
EINDX	Relative entropy diversity index of employment	242	78.228	5.756	77.953	5.228	0.119	9.688
FINDX	Relative entropy diversity index of firm	242	84.028	2.030	83.133	2.534	-1.043	2.774
Endogenous Growth Variables								
EMPDEN	Total employment density per square mile	242	57.764	220.839	69.134	242.914	23.913	22.173
EDUMID	Share of people with high school diploma	242	39.911	3.535	38.247	4.461	-4.021	9.497
EDUHI	Share of people with college degree and higher	242	11.517	4.410	13.399	5.471	16.106	12.336
EDCX	Share of education expenditure in '82 and '92	242	43.413	8.010	45.505	8.692	5.549	15.881
HWAYX	Share of highway expenditure in '82 and '92	242	12.231	5.264	11.063	4.810	6.324	180.184
Natural Amenity Variables								
PC_LAND	1st principal component score of land-based amenities	241	0	1				
PC_RIVER	1st principal component score of river-based amenities	241	0	1				
PC_LAKE	1st principal component score of lake-based amenities	241	0	1				
PC_WARM	1st principal component score of warm weather-based amenities	241	0	1				
PC_COLD	1st principal component score of cold weather-based amenities	241	0	1				

Note: 1. The original variables of natural amenity attributes from the NORSIS database have different measurements. Thus, they are standardized with a mean equal to zero and a standard deviation equal to 1.

2. The number of observations for natural amenity variables is 241 because Menominee County of Wisconsin, an Indian reservation, is not included in the NORSIS.

1980, employment density grew around 24 percent.

In addition to the change in employment density, the profile of educational attainment changed. One of the changed profiles in educational attainment was the relative shrinking of the less-educated population groups and the dramatic increase in college education in a decade. During the 1980s, the proportion of people with a high school diploma decreased by 4 percent. Meanwhile, the proportion with a four-year college education and higher increased by 16 percent. Education took significant portion in general expenditure of a county government in 1982 and 1992. Education expenditure increased by 5.5 percent during the 1980s. Highway expenditure took slightly above 10 percent in general expenditure of a county government during the 1980s. It increased by 6 percent during the decade.

During the 1980 – 1990 period, manufacturing-sector employment maintained its level over the period. The manufacturing sector increased only by 1.6 percent during the decade. In 1990, retail and service employment took more than half of total private employment. During the 1980s, the retail+service sector's employment grew by 6 percent. This contrast employment growth between the manufacturing sector and the retail+service sector may imply that the retail+service sector was the engine of economic growth during that decade. An interesting profile of economic structure is the change in tourism-related employment and establishments. During this period, tourism- related employment grew by 3 percent but tourism-related establishments decreased by 9 percent. This may show that although tourism-related job opportunities remained stable, tourism-related firms experienced closings or consolidations. It is a common perception that this research region has ample natural amenities and that both tourism-related employment and tourism-related firms have increased. This perception may not be true. However, finding the reasons for the instability of tourism-related establishments in the region is

beyond the scope of this research. Two diversity indices show that the diversity levels of both employment and firms remained stable between 1980 and 1990.

The Research Region

The choice of spatial units for measuring income distribution and economic structure is critical because income distribution and economic structure are aggregate characteristics specific to regions. A fairly large region may be required when regional economic structure and income distribution are measured by aggregate employment and income data. Thus, a selected research region should be an area that includes various regional economic characteristics such as commuting behaviors, residential patterns, or labor markets.

To approach the question of the relationship between economic structure and income distribution, this research considered the 242 counties of Michigan, Minnesota, and Wisconsin in the Great Lakes region (Figure 3.2) for the following reasons. First, the study region is a subset of the Great Lakes region,[7] which is the only region of the eight Bureau of Economic Analysis regions that fell below the national average in per capita personal income over the 1929-2000 period (Table 3.4). The Mid-east, the Far West, and the New England regions have experienced decreases in per capita personal incomes but they have remained above the national average. The traditionally lagging regions of the Rocky Mountains, the Plains, and the South have seen per capita personal incomes below the national average but have increased their income levels

[7] The 119 counties in the northern parts of the states of Michigan, Minnesota, and Wisconsin are called the Upper Great Lakes Region (the counties above the red line in Figure 3.2). This region has traditionally lagged behind the nation and the remaining parts of the three states, especially in terms of economic development. Thus, the Upper Great Lakes Regional Commission was created in 1967 to alleviate higher poverty, lower income, higher unemployment, and outmigration through effective industrial development programs (Upper Great Lakes Regional Commission 1970; Sweet et al. 1976).

Figure 3.2 Research Region: The 242 Counties of Three States in the Great Lakes Region

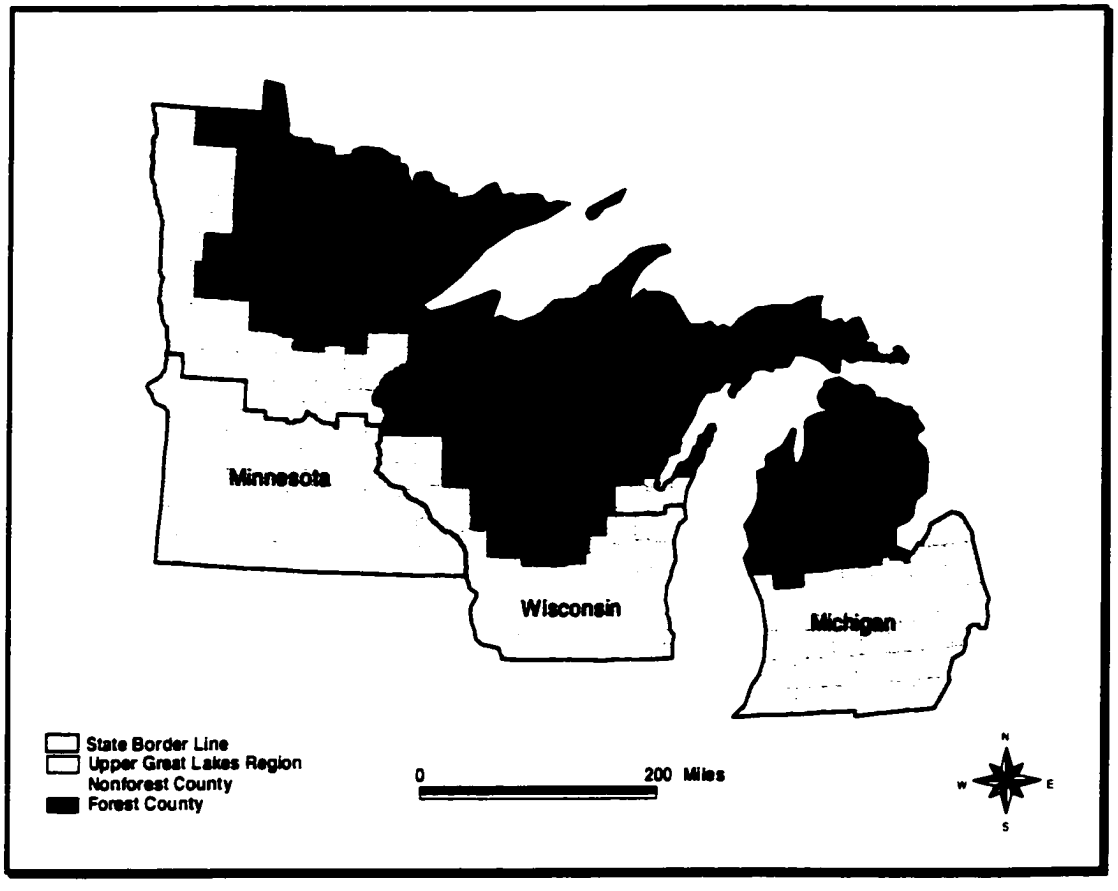


Table 3.4 Per Capita Personal Income in the Bureau of Economic Analysis Regions as a Percentage of the U.S. Average (=100), Selected Years, 1929-2000

Region \ Year	1929	1940	1950	1969	1973	1979	1986	1991[a]	1996[b]	2000[c]
Mid-East	138	133	116	113	110	106	113	116	114	113
Far West	129	132	121	115	110	114	111	107	103	107
New England	125	128	108	110	106	104	116	119	117	121
Great Lakes	**114**	112	111	105	104	104	99	98	100	**99**
Rocky Mts.	85	89	99	89	95	96	91	90	93	95
Plains	82	81	97	93	101	99	95	94	97	96
Southwest	68	71	87	87	89	95	91	88	89	90
Southeast	53	58	74	80	84	85	87	89	91	89

Source: a. Hansen, 1995, p. 91.

b. U.S. Department of Commerce, 2000 (October), State personal income, revised estimates for 1997-99, Survey of Current Business, Table 1, p. 66.

c. Tran, Duke, 2001 (May), Personal income and per capita personal income by state, 2000, Survey of Current Business, Table F, p. 34.

throughout the period. The Great Lakes region, however, has maintained a downward trend in per capita income (Figure 3.3) and may be on the verge of dropping into the status of a lagging region. Thus, an examination of income trends in the study region is a very appropriate research issue.

Second, the economic transition from a manufacturing-based to a service-based economy was equally as evident in the study region as it was in the U.S. as a whole since the 1970s (Figure 3.4). The employment share of the manufacturing sector declined from 28 percent to 14 percent in the U.S. as a whole and from 33 percent to 20 percent in the study region during the 1970-1999 period. Although the study region lost jobs in manufacturing at a slower rate than the U.S. as a whole, the growth rate of service employment in the study region was faster than that of the entire U.S. over the study period. Nevertheless, the share of manufacturing employment in the study region remained higher than the national average. The study region was heavily dependent on manufacturing jobs until the 1970s but since the 1980s, the service sector has dominated in the study region. Both in the U.S. as a whole and in the study region, the service sector has become a dominant and growth-leading sector while the manufacturing sector has lost its dominant status (Table 3.5).

Third, the study region contains a rural region that has ample natural amenities. The consequences of economic restructuring may be as widespread and as deep in rural regions as in urban regions because rural regions tend to have generally limited economic development alternatives. The loss of traditional manufacturing jobs has led many rural regions to find alternative economic activities since the 1980s. Many new economic development strategies that emphasized retail and service sectors proposed taking advantage of natural amenities in rural regions. Many natural amenity-based rural communities have shifted their economies to retail

Figure 3.3 Per Capita Personal Income by Region as a Percentage of the U.S. Average (=100), Selected Years, 1929-2000

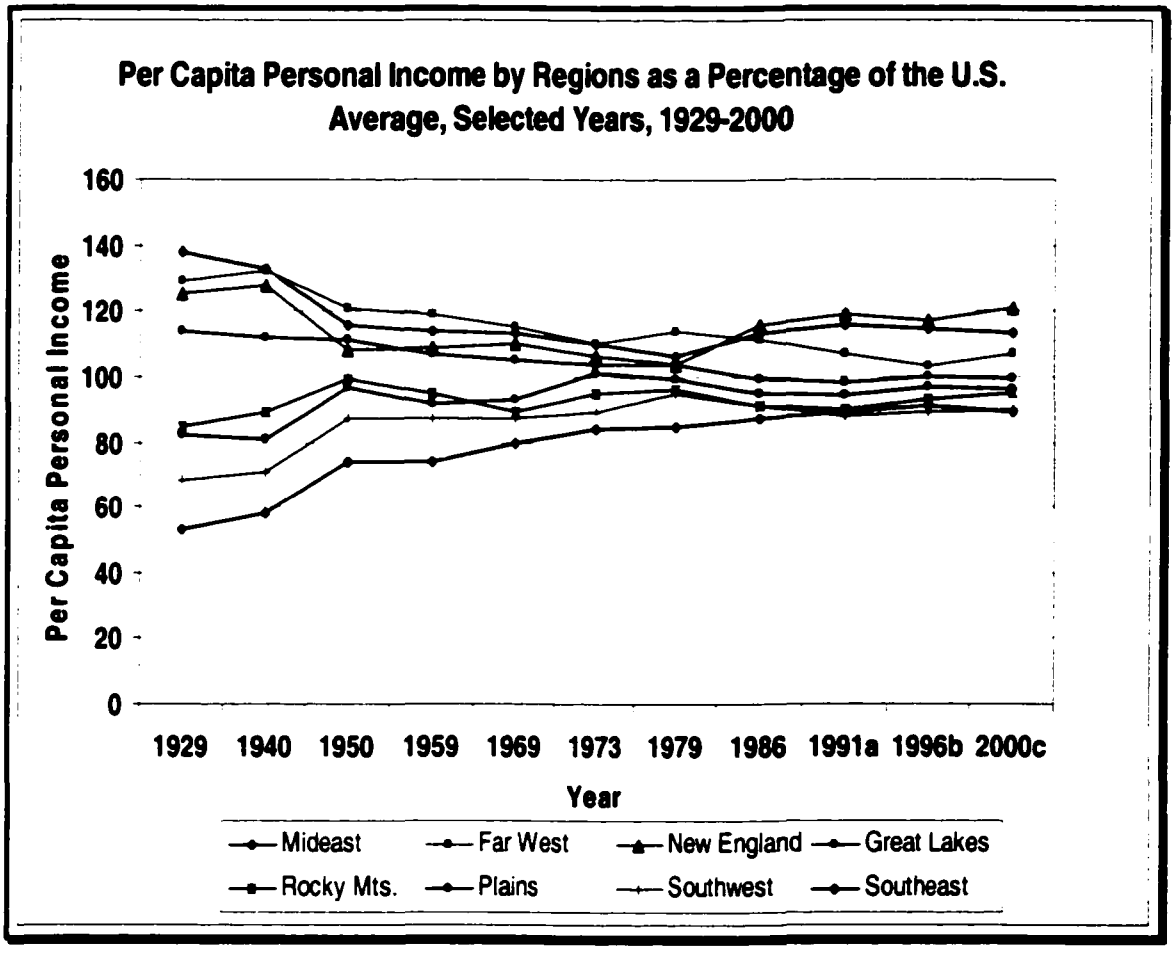


Figure 3.4 Comparison of Economic Restructuring between the U.S. and the Three States

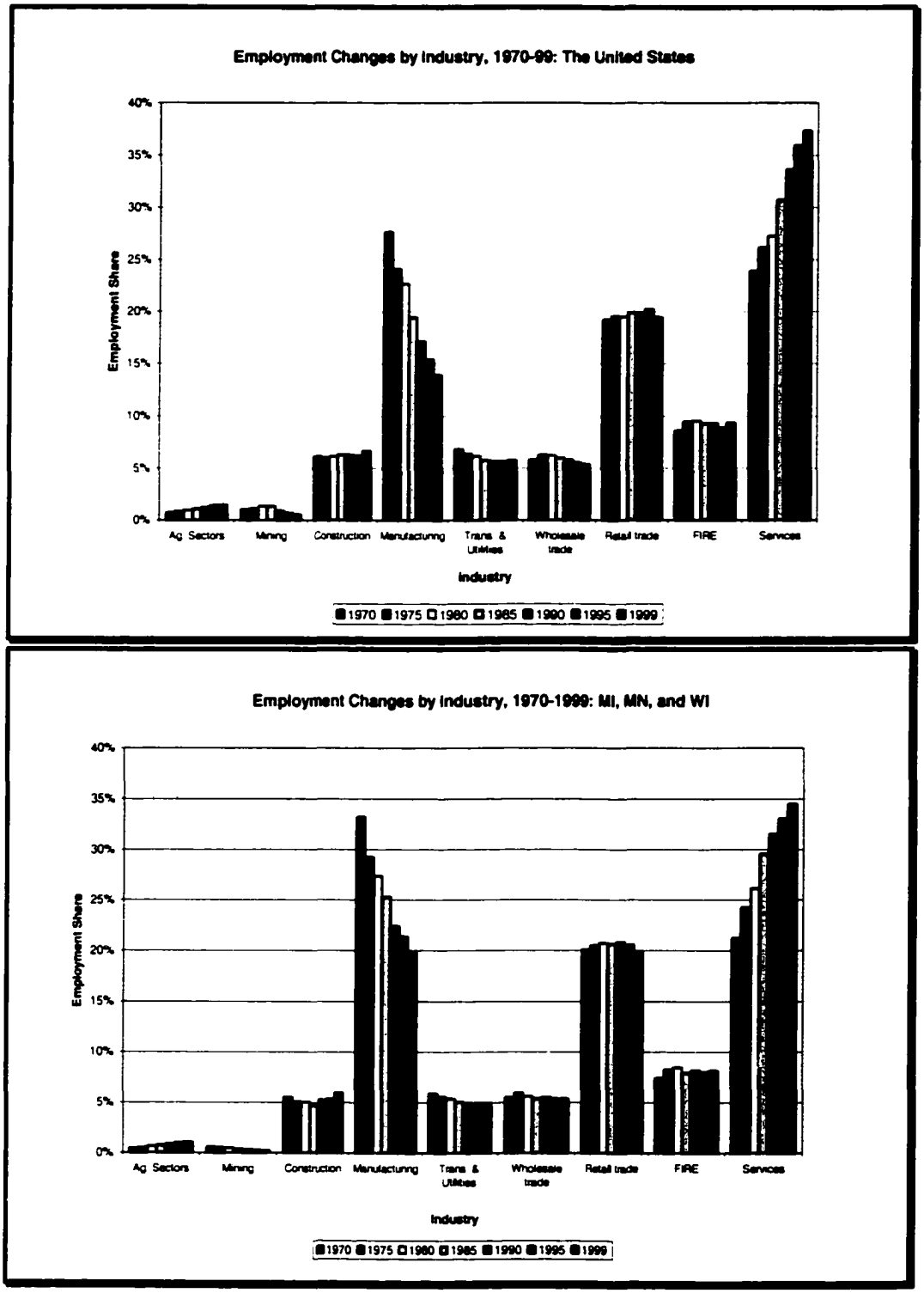


Table 3.5 Changes of Employment Share by Sector, 1970-1999: The U.S. and the Three States
(Unit: Percentage)

U.S.	1970	1975	1980	1985	1990	1995	1999	% Change '70-'99
Ag. Sectors	0.74	0.85	0.99	1.13	1.26	1.44	1.48	100.85
Mining	1.04	1.13	1.39	1.36	0.91	0.71	0.57	-45.85
Construction	6.17	6.02	6.17	6.35	6.31	6.20	6.69	8.36
Manufacturing	**27.63**	**24.09**	**22.67**	**19.43**	**17.12**	**15.40**	**13.92**	**-49.63**
Trans. & Utilities	6.83	6.43	6.19	5.79	5.71	5.68	5.76	-15.63
Wholesale Trade	5.86	6.29	6.26	6.03	5.83	5.56	5.40	-7.86
Retail Trade	19.23	19.58	19.51	19.90	19.92	20.23	19.45	1.18
FIRE	8.60	9.47	9.55	9.32	9.31	8.86	9.38	9.13
Services	**23.90**	**26.14**	**27.27**	**30.69**	**33.64**	**35.93**	**37.35**	**56.27**
Total	100	100	100	100	100	100	100	
3 States	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**1999**	**% Change '70-'99**
Ag. Sectors	0.48	0.54	0.66	0.79	0.91	1.02	1.07	124.96
Mining	0.58	0.55	0.51	0.40	0.34	0.29	0.24	-57.51
Construction	5.50	5.05	5.05	4.74	5.26	5.36	5.98	8.77
Manufacturing	**33.23**	**29.26**	**27.40**	**25.32**	**22.43**	**21.40**	**19.87**	**-40.19**
Trans. & Utilities	5.91	5.59	5.38	5.06	4.96	4.86	4.89	-17.25
Wholesale Trade	5.51	5.94	5.61	5.41	5.52	5.38	5.38	-2.30
Retail Trade	20.11	20.51	20.75	20.70	20.85	20.60	19.86	-1.27
FIRE	7.41	8.26	8.47	7.96	8.17	8.03	8.15	9.93
Services	**21.27**	**24.29**	**26.17**	**29.61**	**31.56**	**33.07**	**34.54**	**62.40**
Total	100	100	100	100	100	100	100	

Source: The Bureau of Economic Analysis's REIS for each year.

and service sectors. Rural regions have increasingly relied on the service sector as an employment source (Smith 1993-2; Summers et al. 1995; Kassab et al. 1995). A study that examines the effects of economic restructuring on income inequality should include rural regions.

The final reason for examining the 242 counties relates to methodological issues. The study region contains heterogeneous economic functioning units from highly developed metropolitan regions (Detroit-Ann Arbor-Flint, MI; Minneapolis-St. Paul, MN; and Milwaukee-Racine, WI) to very rural counties. In addition, the 101 northern forested counties are generally different in topographic features, land use, settlement patterns, economic activities, and demographics from the 141 southern non-forested counties. The heterogeneity within the region indicates different socio-economic behaviors across distinct spatial units. However, different spatial units within the region may interact with each other through transportation systems or communication networks. For example, urban residents enjoy the natural amenity-based recreation and tourism opportunities that are available in the rural regions. The socio-economic heterogeneity and interaction within the region should be controlled for to avoid violating traditional estimation assumptions. Thus, the study region is a relevant space reference for employing the spatial econometrics approach suggested in this research.

In sum, several characteristics of this region justify the study region for this research. First, this region is the only region in the U.S. that has declined in personal income during the last several decades. Second, the national trend of economic restructuring has also occurred in this research region. Third, this region has rich natural amenities that provide a good number of tourism and recreational opportunities. Finally, the heterogeneous spatial characteristics of regional economic profiles may require a spatial estimation method.

CHAPTER 4

EMPIRICAL MODEL EVALUATIONS AND DISCUSSION OF RESULTS

The relationship between economic structure and income distribution in the 242 counties of Michigan, Minnesota, and Wisconsin was evaluated and compared using two different estimation methods. The two methods were an ordinary least squares (OLS) regression model and a spatial error model (SEM). This chapter first evaluates the OLS regression models, then assesses the results of exploratory spatial data analysis (ESDA) to detect spatial autocorrelations, and finally discusses the estimations of the SEM.

Evaluating OLS Regression Models and Spatial Error Models

The empirical OLS regression models are evaluated with the F-value, adjusted R^2, and several other diagnostic statistics such as Variance Inflation Factor (VIF), Tolerance (TOL) [1], and Cook's *d* statistics. The F-value tests the overall significance of a regression model. The F-values of the models were all highly significant ($F<p=0.01$). Adjusted R^2, a "goodness of fit" measure, can be defined as the percentage of the variation of a dependent variable that is explained by a regression model. The adjusted R^2s of the models explained 30 to 60 percent of the variance in the dependent variable. Specifically, the adjusted R^2s of all 1990 static models were around 60 percent and were higher than those of the 1980 static models. The higher explanatory power of the 1990 static models may indicate that income inequality was more evident in 1989 than in 1979.

[1] VIF and TOL are methods of detecting multicollinearity by examining the extent to which a given explanatory variable can be explained by all the other explanatory variables in the equation (Studenmund 2000).

VIF and TOL tests were used to test for multicollinearity. According to the tests, multicollinearity was not a problem in the models. The White test[2] for heteroskedasticity was not significant, indicating that the error terms had a constant variance. Finally, the Cook outlier test (Kennedy 1998) was used to evaluate the leverage effects of outliers. The Cook's *d* statistics did not show significant outliers in the models. In sum, the empirical OLS regression models produced statistically reliable estimates in terms of OLS assumption. The estimation results of the OLS regression were reported and compared with the results of the SEM estimation.

To date, diagnostics like OLS are not available for spatial dependence in the regression model. Major commercial statistical and econometric software programs do not yet provide the diagnostics of spatial models (Anselin and Hudack 1992). A typical test statistic provided for spatial regression analysis is Moran's I for spatial autocorrelation of the dependent variable, the explanatory variables, or the residuals. Several papers with analyses of spatial data reported only the diagnostics for spatial autocorrelation (Immergluck 1999; Rey and Montouri 1999). This research reported Moran's I for spatial autocorrelation of the residuals.

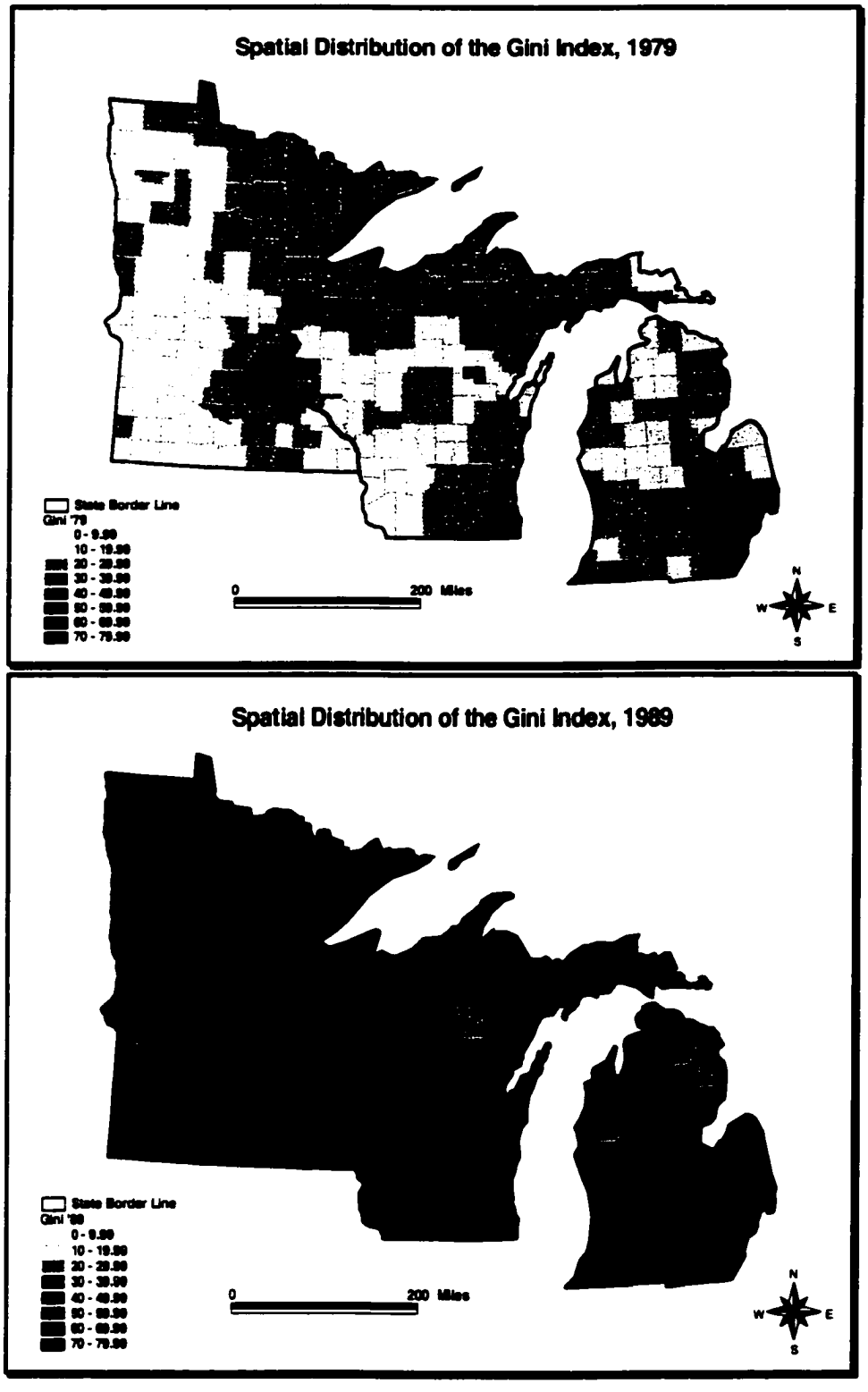
Assessing Exploratory Spatial Data Analyses

Mapping the Gini Income Inequality Index

This section focuses on mapping the spatial distribution of regional Gini indices. The maps of the spatial distributions of the Gini index for 1979 and 1989 appear in Figure 4.1. The 1979 Gini index map shows that the three metropolitan regions of Detroit, Milwaukee, and Minneapolis-St. Paul exhibited higher income inequality (shown in red). There were also several

[2] The White test is an approach for detecting heteroskedasticity by running a regression with the squared residuals as the dependent variable.

Figure 4.1 Spatial Distribution of the Gini Index, 1979 and 1989

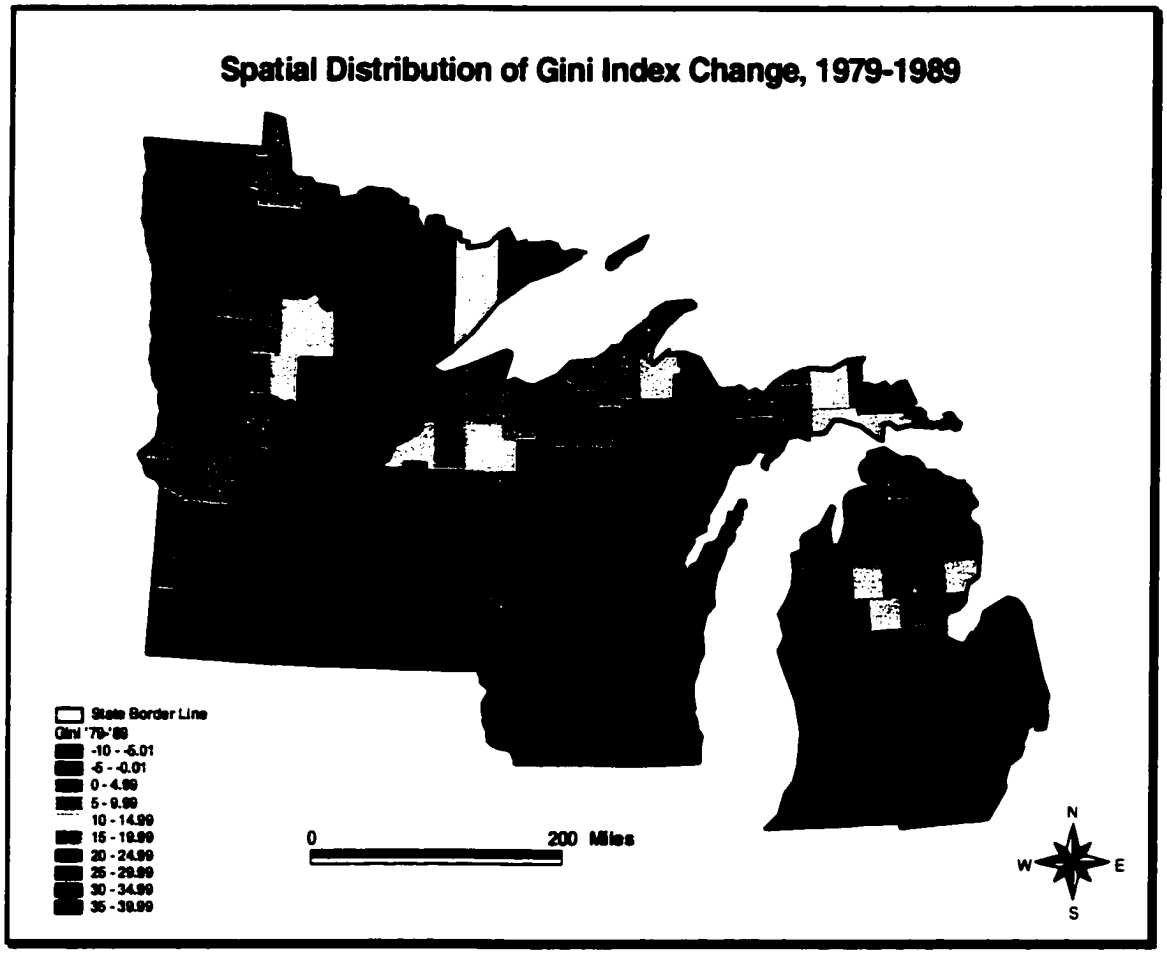


clusters of counties with higher income inequality in northern Minnesota, Wisconsin, and Michigan Upper Peninsula counties. Counties with lower income inequality were clustered in western and southeastern Minnesota, western and southwestern Wisconsin, and central Michigan.

The 1989 Gini index map exhibits that income inequality increased during the 1979-1989 period. By 1989, most counties were shown in dark red, signifying the intensity of income inequality. The spatial distribution of the Gini index in 1989 is similar to that in 1979. The map shows the clustering patterns of higher income inequality in the three metropolitan areas. Specifically, several suburban counties had rapid increases in income inequality in 1989: Oakland, Livingston, and Washtenaw counties of MI, Dakota and Washington counties of MN, and Waukesha and Ozaukee counties of WI. There were several new clusters in 1989: the Grand Rapids-Muskegon-Holland metropolitan region (Allegan, Kent, Muskegon, and Ottawa counties of MI), the Duluth metropolitan region (St. Louis and Carlton counties of MN; Douglas and Bayfield counties of WI), the Wausau metropolitan region (Marathon, Wood, and Portage counties of WI), the Green Bay metropolitan region (Outagamie, Brown, Kewaunee, and Door counties of WI), and several Upper Peninsula counties of MI.

The change in income inequality in the 1979-1989 period appears in Figure 4.2. This map also shows that with some exceptions (shown in blue), most counties of the three states experienced an increase in income inequality during the period. Specifically, the following counties experienced the most rapid increase in income inequality: the suburban counties of the Minneapolis-St. Paul metropolitan region (including St. Croix, Pierce, and Dunn counties of WI), several counties along the Mississippi River (Goodhue, Wabasha, Winona, and Houston counties of MN; Buffalo and La Crosse counties of WI), the Madison metropolitan region (Dane County of WI), the Wausau metropolitan region (Marathon, Wood, and Portage counties of WI),

Figure 4.2 Spatial Distribution of the Gini Index Change, 1979-1989



the Green Bay metropolitan region (Brown, Outagamie, Door, Kewaunee counties of WI), Walworth county of WI, the Grand Rapids-Muskegon-Holland metropolitan region (Ottawa, Kent, Allegan, and Barry counties of MI), and several northwestern counties of MI (Otsego, Leelanau, Emmet, and Grand Traverse counties of MI). The rapid increase in income inequality in metropolitan and suburban counties may indicate that lower-paying service jobs followed the migration of middle- and high-income households to the metropolitan and suburban counties.

The maps above (Figures 4.1 and 4.2) provide two important implications for the spatial distribution of the Gini index. First, income inequality increased in this region during the 1980-1990 period. Second, the spatial pattern of income inequality is clustered rather than random. However, these visual presentations still need further statistical tests.

Global Moran's I for Spatial Autocorrelation of the Gini Index

Global Moran's I statistic for spatial autocorrelation allows a statistical evaluation of the clustering spatial pattern of the Gini index. The global Moran's I statistics were all positive and highly significant (Table 4.1), indicating the presence of positive spatial autocorrelation in the Gini income inequality index. A positive spatial autocorrelation implies that over the entire region, a county's income inequality value tends to be very similar to that of its neighbors. That is, the Moran's I of the Gini income inequality index increased from 0.49 in 1979 to 0.66 in 1989. This indicates that the spatial similarity of income inequality in the region had increased. This captures the regionalization of income inequality across neighboring counties in the region, especially in metropolitan areas. The strong spatial autocorrelation of the Gini indices also indicates that the spatial process of income inequality must be taken into account in model estimation procedures in order to derive efficient and unbiased parameters.

Table 4.1 Global Moran's I of the Spatial Autocorrelation of the Gini Income Index: The 242 Counties of MI, MN, and WI

Variable	First-order Weights Matrix		
	Moran's I	Normal Statistic	p-value
GINI_'79	0.492	12.78	0.000
GINI_'89	0.664	17.20	0.000
GINI_'79-'89	0.460	11.95	0.000

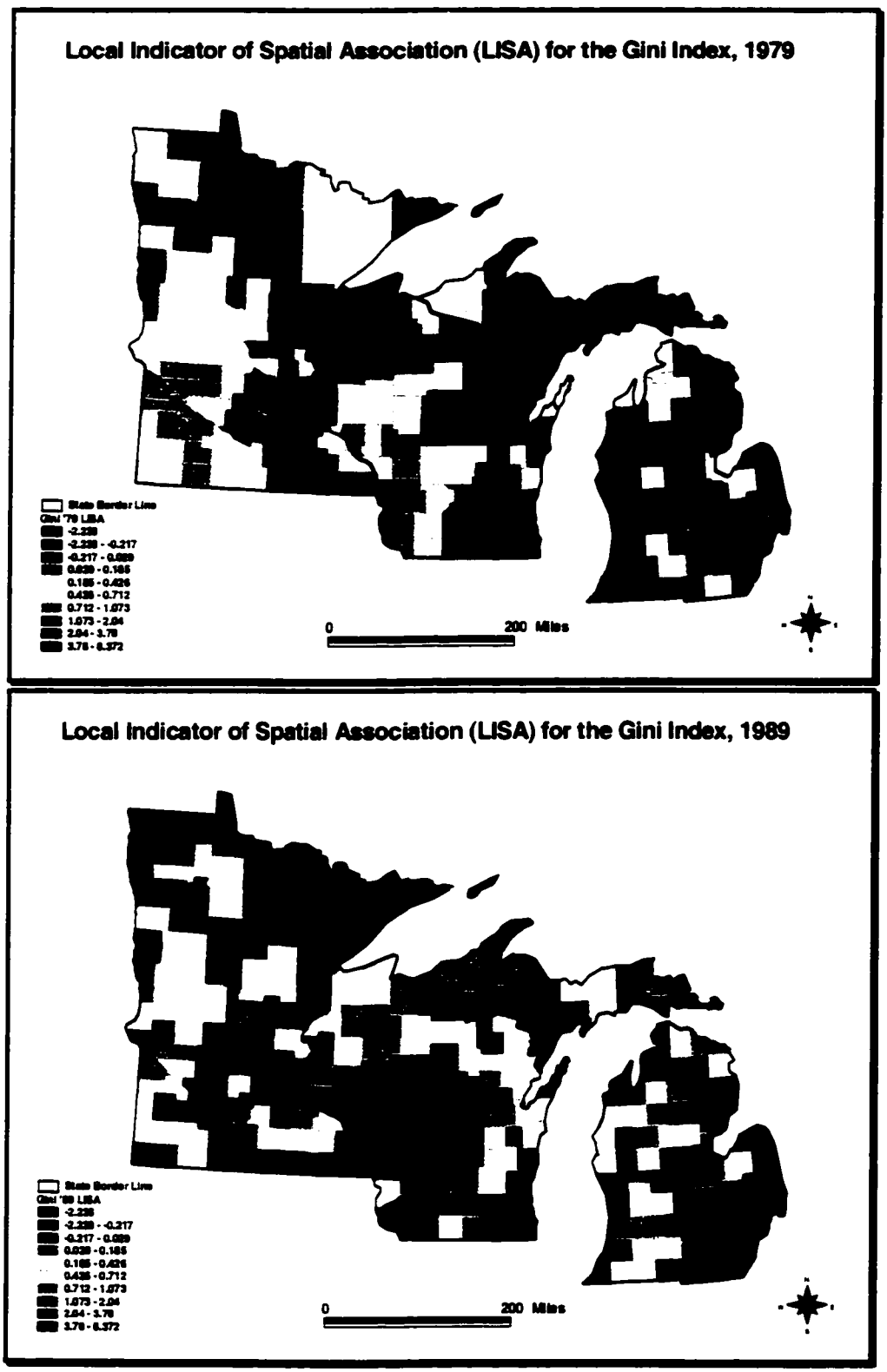
A Local Indicator of Spatial Association: Local Moran's I of the Gini Index

The local indicator of spatial association (LISA) allows identification of local patterns of spatial association for the Gini index. The local Moran maps of the Gini income indices for 1979 and 1989 for the 242 counties appear in Figure 4.3.[3] The map conveys the extent to which neighboring values are associated with each other. In the 1979 LISA map, the three metro areas of Detroit-Ann Arbor, MI; Milwaukee-Racine, WI; and Minneapolis-St. Paul, MN were 'hot spots,' indicating that these metro counties had very similar income inequality values (dark red color = high positive spatial association). The southwestern counties of MN and WI were also 'hot spots.' According to the 1979 Gini distribution (Figure 4.1), the southwestern counties had low-low similar values of income inequality (red color = positive spatial autocorrelation). Blue colors indicate that dissimilar values of the Gini income index are clustered as well.

The 1989 LISA maps also demonstrate positive spatial associations in the three metro areas. The metropolitan 'hot spots' in the 1989 map were larger than were those in the 1979 map, indicating that the spatial association of income inequality has been expanding across these metropolitan regions. Thus, it can be said that income inequality in the metropolitan regions has been regionalized. There were also 'hot spots' in north-central MN, northern WI, the far-western and eastern Upper Peninsula of MI, and northeastern MI. According to the 1989 Gini distribution (Figure 4.1), these counties had relatively lower income inequality. Thus, these counties had positive spatial autocorrelation that came from low-low similar values of income inequality of their neighboring counties.

[3] For the local Moran values, positive values (red colors) indicate spatial clustering of similar values (either high or low), while negative values (blue colors) indicate a clustering of dissimilar values. The local Moran values are classified into 10 classes with natural breaks in the local Moran maps (Figures 4.3 and 4.4).

Figure 4.3 Local Indicator of Spatial Association (LISA) of the Gini Index, 1979 and 1989



The local spatial association of the change in the Gini income index between 1979 and 1989 appears in Figure 4.4. The suburban counties of the MN Twin Cities had very similar change rates of the Gini income index. The WI northern counties, the MI western Upper Peninsula counties, the eastern Upper Peninsula counties, the MI northern counties, and the MI southwestern counties were also 'hot pockets.' These counties had similar change rates of the Gini index with their corresponding neighboring counties.

These LISA maps indicate that the spatial patterns of income inequality were clustered in the three states. They also indicate that the spatial autocorrelation of income inequality may have expanded over time. The LISA maps suggest that the spatial distribution of income inequality needs to be controlled in conventional linear analyses.

The global Moran's I statistics of selected explanatory variables are presented in Table 4.2. The Moran's I values of most socioeconomic and demographic variables were positive and highly significant. In addition, the factor scores of four natural amenity variables had positive and significant Moran's I values. It can be concluded that most of the variables specified in the empirical models of this research were spatially autocorrelated.

So far, the levels and the changes of the Gini income index and other variables have been evaluated for their spatial autocorrelation mainly with global Moran's I and local Moran values. These exploratory spatial data analyses conclude that the variables were affected by spatial processes and that without taking into account the identified spatial processes, the empirical models specified in the research could suffer from misspecification and result in misleading estimates and implications. Therefore, a spatial econometrics approach is required to control for spatial processes in the models and to obtain more efficient and unbiased estimation results.

Figure 4.4 Local Indicator of Spatial Association (LISA) of the Gini Index Change, 1979-1989

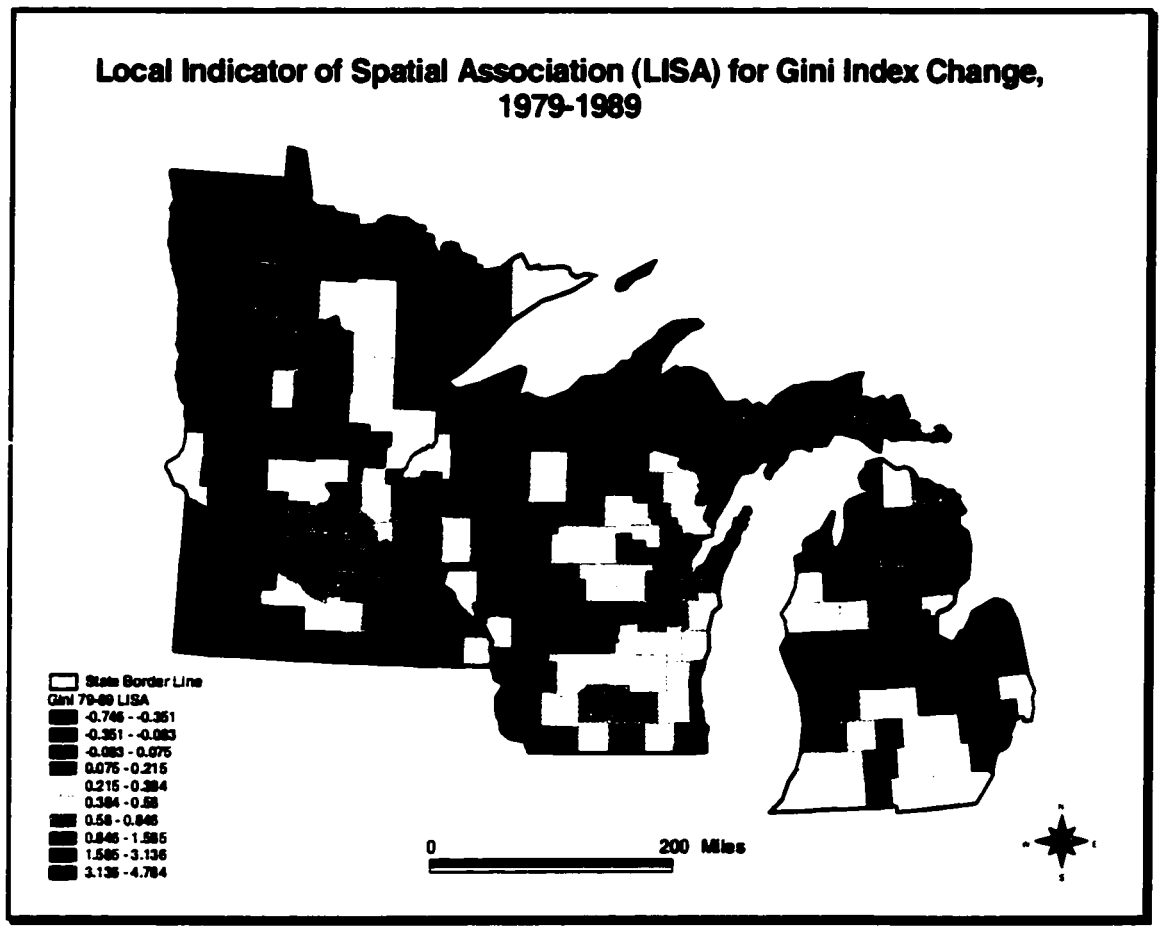


Table 4.2 Global Moran's I of Selected Variables: The 242 Counties of MI, MN, and WI

Variable	Moran's I	Normal Statistic	Normal p-value
MANU '80	0.338	8.795	0.000
MANU '90	0.236	6.170	0.000
MANU '80-'90	**0.011**	0.382	**0.702**
RSVC '80	0.220	5.742	0.000
RSVC '90	0.130	3.455	0.001
RSVC '80-'90	0.102	2.725	0.006
TREMP '80	**0.020**	0.611	**0.541**
TREMP '90	0.122	3.244	0.001
TREMP '80-'90	**-0.010**	-0.149	**0.882**
TFIRM '80	0.336	8.745	0.000
TFIRM '90	0.287	7.487	0.000
TFIRM '80-'90	0.411	10.660	0.000
EINDX '80	**0.010**	0.364	**0.716**
EINDX '90	**0.005**	0.225	**0.822**
EINDX '80-'90	**0.014**	0.470	**0.639**
FINDX '80	0.217	5.667	0.000
FINDX '90	0.577	14.910	0.000
FINDX '80-'90	0.419	10.860	0.000
EMPDEN '80	0.177	4.642	0.000
EMPDEN '90	0.226	5.920	0.000
EMPDEN '80-'90	0.270	7.044	0.000
EDUMID '80	0.336	8.728	0.000
EDUMID '90	0.332	8.639	0.000
EDUMID '80-'90	0.384	9.971	0.000
EDUHI '80	0.207	5.428	0.000
EDUHI '90	0.222	5.794	0.000
EDUHI '80-'90	0.087	2.349	0.019
EDCX '82	0.197	5.161	0.000
EDCX '92	0.174	4.570	0.000
EDCX '82-'92	0.080	2.158	0.031
HWAYX '82	0.250	6.537	0.000
HWAYX '92	0.233	6.089	0.000
HWAYX '82-'92	**0.002**	0.167	**0.867**
PC_LAND	0.736	19.000	0.000
PC_RIVER	0.310	8.073	0.000
PC_LAKE	0.272	7.086	0.000
PC_WARM	0.243	6.339	0.000
PC_COLD	**0.012**	0.408	**0.684**

Note: Bold variables are not significant, implying that they were not spatially autocorrelated.

Detecting Spatial Autocorrelations of Residuals: Moran Scatterplots

This research adopted a spatial error model (SEM) to control for spatial autocorrelation in the error terms. An SEM must successfully control for spatial autocorrelation in the error terms. One way to evaluate the effectiveness of an SEM is with Moran scatterplots for residuals.

The Moran scatterplots of the OLS regression residuals and the SEM residuals appear in Figures 4.5, 4.6, and 4.7 for the level and the change of manufacturing employment models (variable name: *MANU*). The Moran scatterplots of the OLS regression residuals had positive spatial association. The general patterns of the OLS regression residuals were positive spatial associations as reflected by the coefficients of the Wxs corresponding to Moran's I which were driven by the majority of the counties falling in the upper-right and lower-left quadrants.

However, the Moran scatterplots of the residuals of the SEM models show that the spatial autocorrelation among residuals was controlled. The coefficients of the Wxs were almost zero and the slopes, Moran's I, were horizontal. Thus, the Moran scatterplots demonstrate that the SEM specification successfully accounted for spatial autocorrelation in the error terms.

The Moran scatterplots of the OLS regression residuals and the SEM residuals are summarized in Table 4.3 for all models specified in the research. The Moran's I statistics of the OLS regression residuals had positive spatial autocorrelation. However, the Moran's I statistics of the SEM residuals were no longer significant, indicating that the SEM successfully controlled for the spatial autocorrelation of the residuals. The Moran's I statistics for the SEM residuals were also reported in the corresponding estimation result tables in the next section.

Figure 4.5 Moran Scatterplots of OLS and SEM Residuals for Manufacturing Employment, 1980: The 242 Counties of MI, MN, and WI

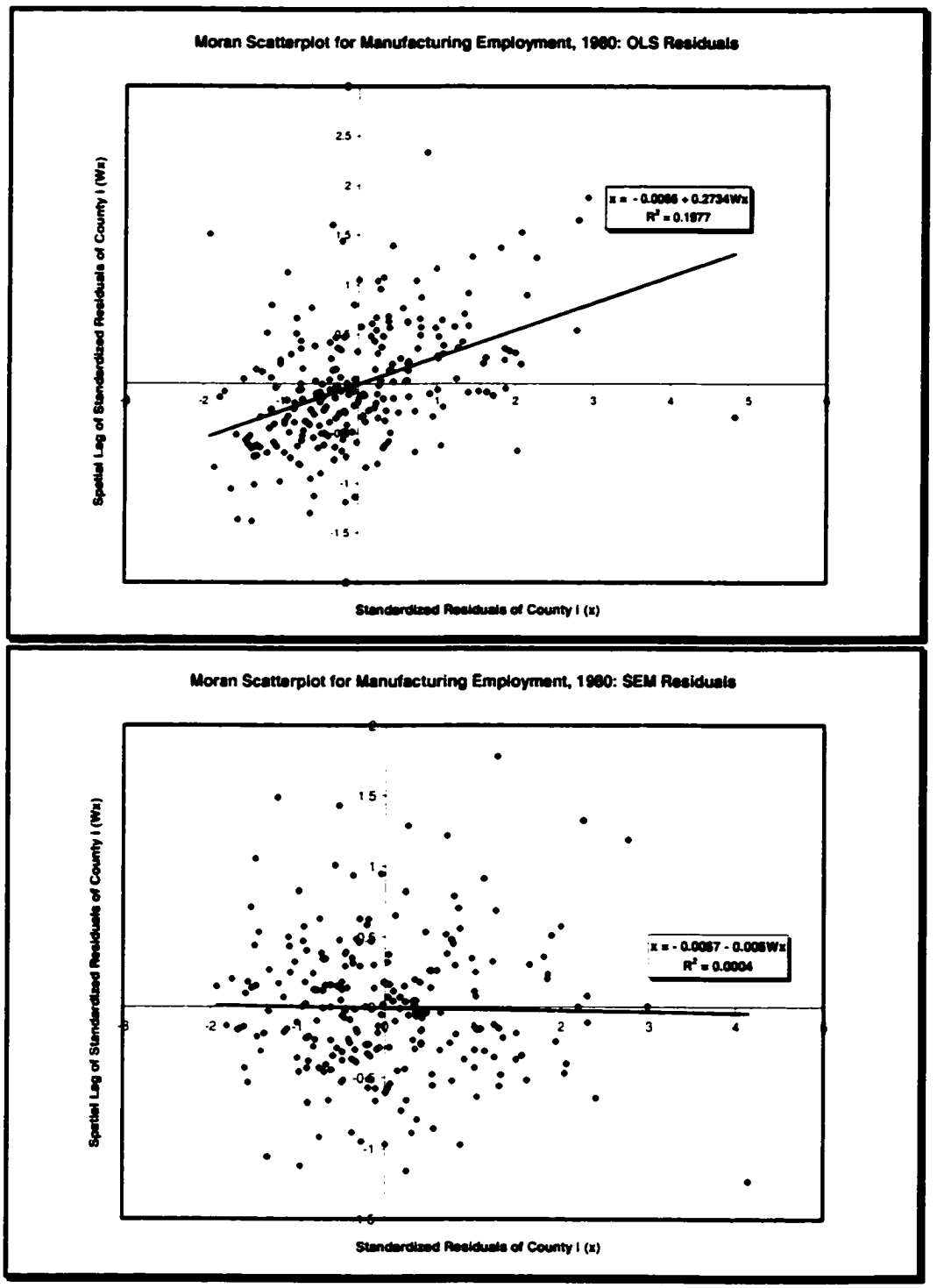


Figure 4.6 Moran Scatterplots of OLS and SEM Residuals for Manufacturing Employment, 1990: The 242 Counties of MI, MN, and WI

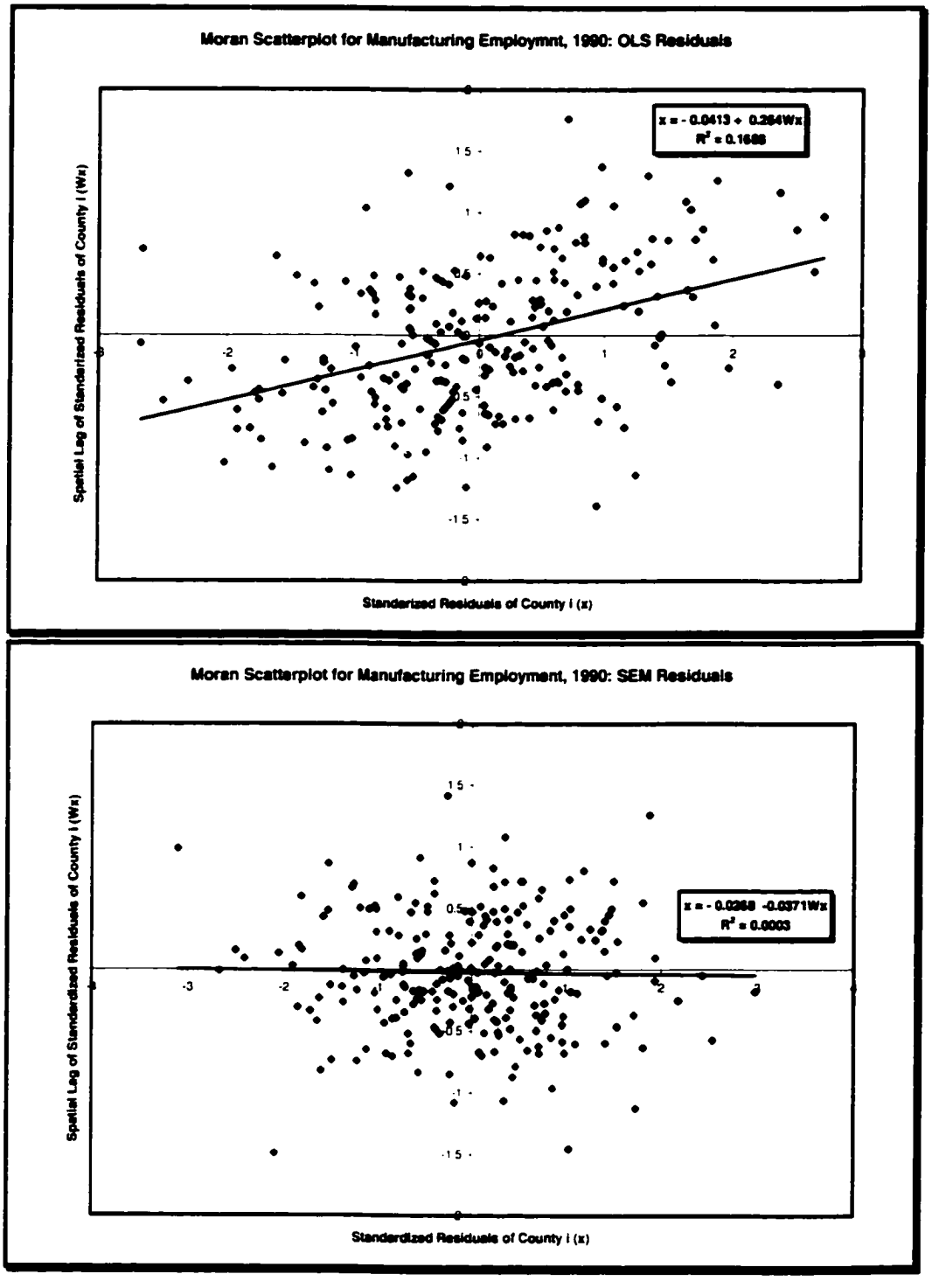


Figure 4.7 Moran Scatterplots of OLS and SEM Residuals for Manufacturing Employment Change, 1980-1990: The 242 Counties of MI, MN, and WI

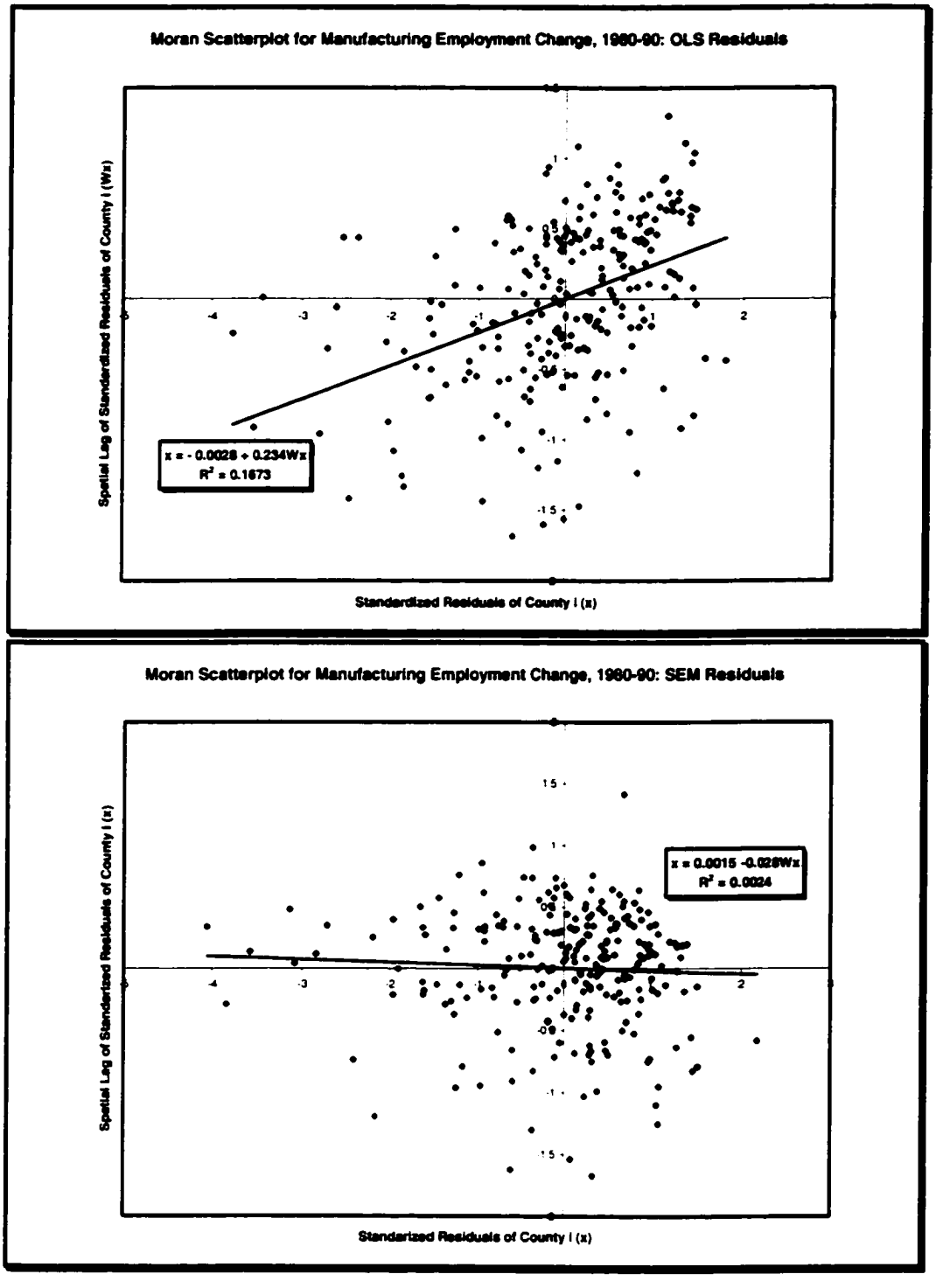


Table 4.3 Moran Scatterplot Summary of OLS and SEM Estimations: The 242 Counties of MI, MN, and WI.

Model Name	OLS Residuals		SEM Residuals	
	Moran's I	p-value	Moran's I	p-value
MANU '80	0.273	0.000	-0.006	0.954
MANU '90	0.264	0.000	-0.037	0.405
MANU '80-'90	0.234	0.000	-0.028	0.547
Retail+Service '80	0.264	0.000	-0.007	0.940
Retail+Service '90	0.297	0.000	-0.039	0.369
Retail+Service '80-'90	0.240	0.000	-0.027	0.552
TREMP '80	0.275	0.000	-0.004	1.000
TREMP '90	0.355	0.030	-0.037	0.405
TREMP '80-'90	0.255	0.000	-0.027	0.552
TFIRM '80	0.243	0.000	-0.012	0.831
TFIRM '90	0.359	0.000	-0.043	0.323
TFIRM '80-'90	0.242	0.000	-0.028	0.541
EINDX '80	0.257	0.000	-0.006	0.964
EINDX '90	0.351	0.000	-0.035	0.427
EINDX '80-'90	0.231	0.000	-0.028	0.542
FINDX '80	0.229	0.000	-0.016	0.761
FINDX '90	0.353	0.000	-0.035	0.429
FINDX '80-'90	0.236	0.000	-0.025	0.597
Full Model '80 with MANU	0.218	0.000	-0.013	0.814
Full Model '80 with Retail+Service	0.213	0.000	-0.013	0.814
Full Model '90 with MANU	0.256	0.000	-0.042	0.330
Full Model '90 with Retail+Service	0.281	0.000	-0.045	0.297
Full Model '80-'90	0.225	0.000	-0.028	0.542

Discussion of Estimation Results

This section discusses the estimation results of different model specifications from the two estimation methods – OLS regression and SEM. This section first discusses the estimation results of six economic structure variable models that contain only one economic structure variable, called the single structure variable model.[4] Thus, the six models examined the relationships between a single economic structure variable and income inequality, while controlling for endogenous growth variables and natural amenity attributes. Then, all economic structure variables were included in one equation, labeled the full structure variable model. Finally, the full structure variable models were evaluated along with the six single models. This section also discusses the distributional effects of endogenous growth variables and natural amenity attributes. These effects were evaluated based on the six single structure variable models as well as the full structure variable models.

Manufacturing Employment Models

The signs of the manufacturing employment level coefficients appeared to be consistent in both the OLS models and the SEMs (Table 4.4). Although the 1980 level of manufacturing employment on income inequality was not statistically significant, the 1990 level had a significant positive effect on income inequality in both the OLS regression model ($p<0.01$) and in the SEM ($p<0.05$). Manufacturing employment tended to increase income inequality during the 1980s but its disequalizing effect might have become statistically evident in the late 1980s.

[4] The six economic structure variables were manufacturing employment, retail+service employment, tourism-related employment, tourism-related establishments, an employment diversity index, and an firm diversity index.

Table 4.4 Manufacturing Employment Models

	1980 Static				1990 Static				1980 – 1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	-7.366	0.170	3.898	0.481	21.888	0.000	30.960	0.000	23.573	0.000	23.966	0.000
MANU	0.016	0.660	0.014	0.661	0.278	**0.000**	0.159	**0.000**	-0.020	0.142	-0.007	0.563
EMPDEN	0.004	**0.013**	-0.002	0.144	0.001	0.560	-0.002	0.205	0.055	**0.021**	0.027	0.229
EDUMID	0.520	**0.000**	0.327	**0.004**					-0.195	**0.003**	-0.317	**0.000**
EDUHI	0.548	**0.000**	0.417	**0.000**	1.048	**0.000**	0.852	**0.000**	0.027	0.609	0.007	0.889
EDCX	0.062	0.189	0.000	0.999	0.202	**0.000**	0.122	**0.003**	0.078	**0.012**	0.045	**0.097**
HWAYX	-0.040	0.602	0.053	0.438	-0.185	**0.047**	-0.117	0.126	-0.009	**0.001**	-0.003	0.194
PC_LAND	-0.806	**0.033**	-1.581	**0.001**	-2.225	**0.000**	-0.505	0.383	-2.096	**0.000**	0.042	0.953
PC_RIVER	1.559	**0.000**	1.111	**0.001**	-0.985	**0.017**	-0.557	0.131	-2.551	**0.000**	-1.604	**0.001**
PC_LAKE	0.387	0.256	0.127	0.690	-0.713	**0.079**	-0.486	0.181	-1.209	**0.015**	-0.738	0.126
PC_WARM	-0.929	**0.014**	-1.095	**0.001**	-1.196	**0.008**	-0.445	0.237	-0.998	**0.068**	-0.063	0.900
PC_COLD	-0.374	0.287	-0.555	**0.053**	-0.267	0.525	-0.365	0.271	0.218	0.675	0.390	0.386
F-value	13.13	**0.000**			48.48	**0.000**			11.12	**0.000**		
Adj. R^2	0.357				0.664				0.317			
White test	83.21	0.294			66.78	0.416			76.27	0.502		
Moran's I	0.273	**0.000**	-0.006	0.954	0.264	**0.000**	-0.037	0.405	0.234	**0.000**	-0.028	0.547

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

Thus, in contrast to the conventional idea that manufacturing jobs have equalizing effects (Bluestone and Harrison 1982; Chevan and Stokes 2000), the level of manufacturing employment was a disequalizing factor in 1990 in the region.

Change in manufacturing employment was not statistically associated with income inequality change. The change model failed to find a linkage between manufacturing employment growth and income inequality change. This may imply that a policy of increasing manufacturing employment may not affect income distribution in the region.

The disequalizing effect in 1990 indicated that traditionally high-paying manufacturing jobs might not be available in the region or may have left for the southern U.S. or abroad. The remaining low-paying manufacturing jobs tend to increase income inequality in the region.

Retail+service Employment Models

The 1980 retail+service employment level was not statistically significant (Table 4.5); however, the 1990 level had a significant negative effect on income inequality in both the OLS regression and in the SEM ($p<0.01$). This change implied that in 1990, the level of retail+service employment have reduced income inequality in the region.

The 1990 level of manufacturing employment showed an increase in income inequality (Table 4.4), while the 1990 level of retail+service employment might have contributed to decreasing income inequality in the region. This finding, however, suggests that given poor quality jobs of the retail and service sector created in the region, the equalzing distributional effect of retail and service employment may result from decreasing overall income level in a county, as a whole.

Table 4.5 Retail+service Employment Models

	1980 Static				1990 Static				1980-1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	-11.718	0.066	2.512	0.681	45.085	0.000	45.292	0.000	22.982	0.000	23.865	0.000
RSVC	0.053	0.258	0.020	0.607	-0.315	**0.000**	-0.186	**0.000**	0.058	0.363	0.006	0.916
EMPDEN	0.004	**0.011**	-0.002	0.148	0.001	0.5707	-0.002	0.136	0.059	**0.023**	0.025	0.311
EDUMID	0.587	**0.000**	0.355	**0.002**					-0.204	**0.003**	-0.326	**0.000**
EDUHI	0.548	**0.000**	0.411	**0.000**	1.088	**0.000**	0.880	**0.000**	0.030	0.570	0.010	0.831
EDCX	0.054	0.255	-0.005	0.897	0.185	**0.000**	0.102	**0.012**	0.078	**0.012**	0.045	**0.097**
HWAYX	-0.062	0.418	0.041	0.547	-0.233	**0.013**	-0.160	**0.033**	-0.009	**0.001**	-0.003	0.209
PC_LAND	-0.865	**0.022**	-1.597	**0.001**	-2.162	**0.000**	-0.618	0.284	-1.994	**0.000**	0.075	0.915
PC_RIVER	1.584	**0.000**	1.125	**0.001**	-1.014	**0.015**	-0.721	**0.049**	-2.590	**0.000**	-1.616	**0.001**
PC_LAKE	0.351	0.304	0.124	0.696	-0.615	0.134	-0.377	0.300	-1.227	**0.014**	-0.738	0.130
PC_WARM	-1.019	**0.008**	-1.137	**0.001**	-1.027	**0.024**	-0.365	0.333	-0.939	**0.087**	-0.035	0.945
PC_COLD	-0.433	0.220	-0.572	**0.047**	-0.087	0.839	-0.201	0.544	0.263	0.614	0.408	0.364
F-value	13.29	**0.000**			47.04	**0.000**			10.94	**0.000**		
Adj. R^2	0.360				0.657				0.313			
White test	81.2	0.350			72.29	0.250			68.86	0.735		
Moran's I	0.264	**0.000**	-0.007	0.940	0.297	**0.000**	-0.039	0.369	0.240	**0.000**	-0.027	0.552

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

This research failed to find statistical evidence of the effects of the change in retail+service employment on income inequality. The employment change in the retail+service sector was not statistically significant in either the OLS model or the SEM. This suggests that rapid employment growth in the retail+service sector did not statistically affect change in income inequality in the region. It is interesting that although counties with higher levels of retail+service employment had lower income inequality than did other counties, the change in retail+service employment had no statistical effect on income distribution in the region. This suggests that a policy focusing on stimulating the retail+service sectors may not be effective in equalizing the distribution of income.

One interesting note is that the change models of manufacturing employment (Table 4.4) have consistently negative signs in both estimation methods even though the models were not significant. The change models of retail+service employment (Table 4.5) showed the positive association with income inequality even though the models were also not significant. Although the changes in both manufacturing and retail+service employment were not significant, their signs might be consistent with the deindustrialization hypothesis that the manufacturing sector has an equalizing effect, while the retail and service sector has a disequalizing distributional effect. It, thus, may need to understand with caution the findings from the level models: the disequalizing effect of manufacturing employment in 1990 (Table 4.4) and the equalizing effect of retail+service employment in 1990 (Table 4.5).

Another interesting note is that according to the deindustrialization perspective, economic restructuring is the most powerful cause of increased income inequality (Bluestone and Harrison 1982; Kassab 1992; Morris and Western 1999; Chevan and Stokes 2000). Many assume that the changes in manufacturing and service employment are statistically associated with income

inequality change. However, although the change models in this research covered just one decade, 1980-1990, this research found no statistical association of the changes in manufacturing and retail+service employment with income inequality change.

This lack of association may result from the several issues. First, while many empirical studies have been based on the U.S. as a whole, this research is based on only three states. Second, changes in economic structure measured by employment data may have weak distributive effects because the employment data may not reflect various job qualities or salary structures across different sectors or within a sector. Third, while the economic significance of service industries has increased, variation within the service sector has increased. Aggregate employment data of the retail+service sector may not capture the dualistic nature of retail+service industries. Thus, this research employed the tourism industry as a subset of the retail+service sector and examined the effect of tourism-related employment or firms on income distribution.

Tourism-related Employment Models

The number of tourism-related employment was not significant in either 1980 or in 1990 (Table 4.6). The coefficients of both OLS and SEM level models in 1980 and 1990 consistently had negative signs. Although they were not significant, the negative signs might indicate that a county with higher tourism-related employment had equal income distribution.

The OLS change model had marginally significant negative association with income inequality ($p<0.1$), implying that rapid growth in tourism-related employment contributed to reducing income inequality in the region. No significant association of tourism-related

Table 4.6 Tourism-related Employment Models

	1980 Static				1990 Static				1980-1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	-7.264	0.174	4.670	0.399	30.383	0.000	36.975	0.000	23.948	0.000	23.836	0.000
TREMP	-0.049	0.521	-0.081	0.184	-0.132	0.133	-0.048	0.480	-0.025	**0.093**	-0.014	0.273
EMPDEN	0.004	**0.014**	-0.002	0.126	0.001	0.510	-0.003	0.119	0.044	**0.055**	0.027	0.220
EDUMID	0.538	**0.000**	0.336	**0.002**					-0.251	**0.000**	-0.337	**0.000**
EDUHI	0.563	**0.000**	0.436	**0.000**	1.014	**0.000**	0.797	**0.000**	0.006	0.902	-0.003	0.948
EDCX	0.066	0.168	0.007	0.867	0.223	**0.000**	0.115	**0.007**	0.098	**0.002**	0.065	**0.018**
HWAYX	-0.046	0.543	0.042	0.530	-0.291	**0.005**	-0.184	**0.021**	-0.009	**0.001**	-0.003	0.155
PC_LAND	-0.807	**0.032**	-1.591	**0.001**	-2.209	**0.000**	-0.610	0.312	-1.961	**0.000**	-0.358	0.608
PC_RIVER	1.588	**0.000**	1.147	**0.000**	-1.143	**0.013**	-0.779	**0.045**	-2.454	**0.000**	-1.449	**0.004**
PC_LAKE	0.419	0.225	0.181	0.570	-0.866	**0.051**	-0.554	0.142	-1.186	**0.014**	-0.809	**0.085**
PC_WARM	-0.885	**0.022**	-0.987	**0.004**	-1.382	**0.006**	-0.563	0.158	-0.814	0.127	-0.089	0.856
PC_COLD	-0.367	0.296	-0.524	**0.067**	-0.239	0.603	-0.342	0.321	0.129	0.799	0.241	0.586
F-value	13.16	**0.000**			36.79	**0.000**			11.39	**0.000**		
Adj. R^2	0.358				0.599				0.324			
White test	84.36	0.265			73.17	0.228			74.6	0.556		
Moran's I	0.275	**0.000**	-0.004	1.000	0.355	**0.030**	-0.037	0.405	0.255	**0.000**	-0.027	0.552

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

employment was found in the SEM. Thus, the finding may indicate that a model that does not control for a possible spatial process may lead to wrong policy implications.

Tourism-related employment was not statistically significant in the SEM change model. Although the 242 counties of the three states had ample natural amenities and have worked to promote tourism-based economic development, the share of tourism-related employment remained around 15 percent in the 1980-1990 period, growing only 3 percent between 1980 and 1990. This finding suggests that tourism economic development may not be fully mature or may not be as strong as would be expected in the region.

However, it is worthwhile to note two issues concerning tourism employment data. First, the definition of the tourism sector is not always clear and there are different definitional perspectives on tourism (Smith 1988). Thus, there is no one consistent way to identify tourism-related sectors and employment. Many use a 2-digit SIC code for tourism that is still highly aggregate. Second, tourism-related employment data suffer from the problem of disclosure and suppression in the County Business Patterns (CBP) dataset. Most tourism-related firms were so small that the numbers of their employees were not easily captured in this secondary data source. Therefore, unless there is a better way to define tourism sectors or an improved scheme to collect information on tourism activities including employment data, we may not be able to adequately evaluate the actual effects of tourism-related sectors on regional economies.

Tourism-related Firm Models

To avoid the problem of disclosure in CBP, this research employed the number of tourism-related firms. This was done to evaluate the effects of tourism activities on income distribution in the region. The coefficients of tourism firms in the 1980 and 1990 level models

Table 4.7 Tourism-related Firm Models

	1980 Static				1990 Static				1980-1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	-15.911	0.002	-4.199	0.447	39.623	0.000	45.419	0.000	23.405	0.000	24.139	0.000
TFIRM	0.399	**0.000**	0.301	**0.000**	-0.447	**0.000**	-0.355	**0.000**	-0.014	0.766	0.032	0.483
EMPDEN	0.004	**0.014**	-0.002	0.160	0.001	0.542	-0.003	0.107	0.047	**0.058**	0.027	0.220
EDUMID	0.523	**0.000**	0.356	**0.001**					-0.228	**0.000**	-0.331	**0.000**
EDUHI	0.538	**0.000**	0.430	**0.000**	0.958	**0.000**	0.764	**0.000**	0.030	0.577	0.011	0.814
EDCX	0.086	**0.054**	0.018	0.639	0.169	**0.002**	0.083	**0.047**	0.077	**0.013**	0.045	0.100
HWAYX	-0.145	**0.046**	-0.034	0.601	-0.195	**0.052**	-0.123	0.112	-0.009	**0.001**	-0.003	0.200
PC_LAND	-1.264	**0.001**	-1.726	**0.000**	-2.027	**0.000**	-0.517	0.379	-1.977	**0.001**	0.096	0.892
PC_RIVER	1.120	**0.001**	1.060	**0.001**	-0.744	**0.096**	-0.683	**0.065**	-2.614	**0.000**	-1.584	**0.001**
PC_LAKE	0.201	0.531	-0.050	0.870	-0.513	0.249	-0.276	0.460	-1.144	**0.024**	-0.745	0.122
PC_WARM	-1.669	**0.000**	-1.451	**0.000**	-1.012	**0.041**	-0.309	0.424	-0.969	**0.081**	-0.010	0.984
PC_COLD	-0.628	**0.058**	-0.811	**0.004**	0.068	0.882	-0.040	0.908	0.271	0.604	0.393	0.381
F-value	18.03	**0.000**			39.76	**0.000**			10.83	**0.000**		
Adj. R^2	0.4384				0.618				0.311			
White test	84.16	0.270			72.2	0.252			78.61	0.428		
Moran's I	0.243	**0.000**	-0.012	0.831	0.359	**0.000**	-0.043	0.323	0.242	**0.000**	-0.028	0.541

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

were highly significant but the signs of their corresponding coefficients were not consistent over time (Table 4.7). Tourism-related firm levels had positive coefficients in the 1980 models but negative coefficients in the 1990 models. Tourism-related firms in the 1980 models were associated with increased income inequality. This effect of the number of tourism-related firms was drastically reversed in 1990; in 1990 tourism-related firms had an equalizing effect on income distribution in the region. Both estimations – the OLS regression and the SEM – consistently showed this same reversal. In addition, several different model specifications produced the same reversal, so the reverse of the effect was obviously not due to different model specifications. Tourism-related firm data at the 3-digit SIC level in the CBP did not suffer from the disclosure problem, so the reverse tendency should not be the result of data quality. From a statistical point of view, the number of tourism-related firms tended to increase income inequality in the 1980 models but to lower income inequality in the 1990 models. Certainly, tourism-related firms appeared to have changed their distributional characteristics, at least in this regional economy, over the 1980-1990 period.

The number of tourism-related firms decreased by 9 percent in the region during the 1980s (see Table 3.3, p. 82). This was puzzling because this region has been perceived to be active in developing tourism by taking advantage of ample natural amenities (Marcouiller and Mace 1999). Further attention to tourism-related firms in the region may be necessary as the number of tourism-related firms changes over time.

The change in the number of tourism-related firms was not statistically significant in either the OLS regression or the SEM. This research failed to find statistical evidence for any effect of change in tourism-related firms on change in income inequality in the region. Although

the coefficients of tourism change were not significant in either model, it is notable that the two models had different signs.

So far, this research has examined sector-specific effects on income distribution but has paid little attention to the effects of the economic structure as a whole on income distribution. Thus, two entropy diversity indices were employed to represent the characteristics of the overall economic structure in the regional economy: the employment diversity index and the firm diversity index.

Employment Diversity Index Models

The 1980 level of the economic diversity index was significant only in the OLS regression and had negative signs in both estimation methods (Table 4.8). The negative signs suggest that a county with a relatively more diversified employment structure across sectors was likely to have lower income inequality. According to the regional science literature, a diversified economy tends to grow rapidly and to be relatively stable. In addition, the finding from the 1980 OLS model of the economic diversity index suggests that a diversified economy may not only be stable and grow rapidly but may also decrease income inequality. The finding, however, was not statistically conclusive. Employment diversity was not statistically significant in the 1980 SEM. Furthermore, the finding did not gain support from the 1990 models. The employment diversity indices in the 1990 OLS regression and SEM were not significant.

It may be noted here that an entropy diversity index is a static measure that indicates a level of diversity in a given time period. Thus, change in an entropy diversity index may not be appropriate for measuring the dynamics of economic structure over a period of time. In addition, change in an entropy diversity index over a given period may not imply that the effects of the

Table 4.8 Employment Diversity Index Models

	1980 Static				1990 Static				1980-1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	4.754	0.546	9.690	0.197	18.271	0.019	34.788	0.000	23.316	0.000	23.876	0.000
EINDX	-0.149	**0.035**	-0.065	0.247	0.127	0.155	0.018	0.773	0.129	0.133	0.027	0.707
EMPDEN	0.004	**0.011**	-0.002	0.147	0.001	0.472	-0.002	0.130	0.059	**0.015**	0.027	0.247
EDUMID	0.526	**0.000**	0.325	**0.003**					-0.199	**0.002**	-0.322	**0.000**
EDUHI	0.542	**0.000**	0.407	**0.000**	0.993	**0.000**	0.791	**0.000**	0.037	0.482	0.012	0.806
EDCX	0.063	0.179	0.001	0.991	0.219	**0.000**	0.114	**0.007**	0.075	**0.016**	0.044	0.108
HWAYX	-0.061	0.416	0.032	0.632	-0.229	**0.026**	-0.168	**0.037**	-0.009	**0.001**	-0.003	0.197
PC_LAND	-0.910	**0.016**	-1.607	**0.001**	-2.242	**0.000**	-0.613	0.311	-2.073	**0.000**	0.055	0.938
PC_RIVER	1.448	**0.000**	1.075	**0.001**	-0.960	**0.035**	-0.717	**0.060**	-2.626	**0.000**	-1.634	**0.001**
PC_LAKE	0.364	0.281	0.130	0.682	-0.971	**0.029**	-0.585	0.123	-1.254	**0.012**	-0.752	0.121
PC_WARM	-0.882	**0.018**	-1.068	**0.001**	-1.674	**0.001**	-0.642	0.102	-1.062	**0.055**	-0.058	0.909
PC_COLD	-0.425	0.222	-0.561	**0.050**	-0.153	0.744	-0.347	0.322	0.390	0.458	0.439	0.337
F-value	13.77	**0.000**			36.73	**0.000**			11.13	**0.000**		
Adj. R^2	0.369				0.598				0.317			
White test	84.0	0.274			59.58	0.667			85.64	0.234		
Moran's I	0.257	**0.000**	-0.006	0.964	0.351	**0.000**	-0.035	0.427	0.231	**0.000**	-0.028	0.542

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

diversity change on structural stability are either good or bad in a regional economy. The change coefficients of the employment diversity index were not significant in either model.

Firm Diversity Index Models

The 1980 levels of the firm diversity index appeared to be consistent in both the OLS regression and the SEM (Table 4.9). The 1980 level of firm diversity index was highly associated with the level of income inequality. Both estimation methods – the OLS regression and the SEM – showed negative signs. Thus, a county with more diverse firms across sectors would be expected to have lower income inequality. The 1990 levels of the firm diversity index were not significant in either model even though the signs remained negative in both estimation models. Like the conclusion based on the employment diversity index levels, the effect of the firm diversity level on the level of income inequality was inconclusive.

The change in the level of firm diversity was positively significant ($p<0.05$) in the OLS regression, implying that a county with rapidly diversifying firms might experience an increase in income inequality. This implication is not consistent with the hypothesis of this research that economic diversity decreases income inequality. The positive association on the change in the level of firm diversity with change in income inequality, however, did not gain statistical support from the SEM because the coefficient was not significant.

Both the employment and the firm diversity indices had negative signs in the 1980 models. In the 1990 models, the 1990 levels of the employment index had positive signs but the 1990 level of firm diversity index had negative signs. In addition, the change coefficients of both the employment and the firm diversity indices had positive signs in both estimation methods. Most of the diversity indices were not statistically significant. The findings suggest that the

Table 4.9 Firm Diversity Index Models

	1980 Static				1990 Static				1980-1990 Change			
Dep. Var.	GINI_79				GINI_89				GINI_79-89			
Model	OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	77.621	0.000	49.745	0.001	55.883	0.003	38.074	0.028	24.170	0.000	24.215	0.000
FINDX	-0.923	**0.000**	-0.523	**0.001**	-0.323	0.131	-0.021	0.916	0.407	**0.041**	0.176	0.367
EMPDEN	0.002	0.303	-0.003	**0.046**	0.001	0.693	-0.003	0.131	0.052	**0.025**	0.025	0.260
EDUMID	0.450	**0.000**	0.334	**0.002**					-0.265	**0.000**	-0.334	**0.000**
EDUHI	0.406	**0.000**	0.360	**0.000**	0.975	**0.000**	0.788	**0.000**	-0.001	0.981	0.002	0.967
EDCX	0.010	0.832	-0.024	0.551	0.200	**0.000**	0.114	**0.009**	0.082	**0.008**	0.048	**0.079**
HWAYX	-0.057	0.427	0.041	0.529	-0.204	**0.057**	-0.171	**0.032**	-0.009	**0.001**	-0.003	0.162
PC_LAND	-0.809	**0.024**	-1.503	**0.002**	-2.430	**0.000**	-0.622	0.304	-1.738	**0.002**	0.095	0.894
PC_RIVER	1.359	**0.000**	1.066	**0.001**	-1.156	**0.012**	-0.722	**0.058**	-2.506	**0.000**	-1.651	**0.001**
PC_LAKE	0.456	0.161	0.144	0.644	-0.883	**0.047**	-0.573	0.128	-1.236	**0.012**	-0.737	0.126
PC_WARM	-1.304	**0.000**	-1.315	**0.000**	-1.728	**0.001**	-0.634	0.111	-0.915	**0.093**	-0.057	0.910
PC_COLD	-0.300	0.369	-0.507	**0.073**	-0.216	0.641	-0.362	0.295	0.159	0.759	0.383	0.394
F-value	16.73	**0.000**			36.79	**0.000**			11.41	**0.000**		
Adj. R^2	0.419				0.599				0.323			
White test	68.88	0.734			60.11	0.648			71.11	0.668		
Moran's I	0.229	**0.000**	-0.016	0.761	0.353	**0.000**	-0.035	0.429	0.236	**0.000**	-0.025	0.597

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

distributional effect of economic diversity was not conclusive in the region during the 1980s. Thus, this finding may indicate that economic structure measured by a diversity index failed to have a linkage to income distribution.

The Full Structure Variable Models

All economic structure variables were included in the equations, which were termed the "full structure variable models." To examine the distributional effects of first the manufacturing sector and then the retail+service sector while controlling for other economic structure variables, endogenous growth variables, and natural amenity variables, this research developed two sets of model specifications for the 1980 and for the 1990 models. The first set did not contain the retail+service employment variable and the second set did not include the manufacturing employment variable because of the high correlation between the two sectors. This section begins with a discussion of the estimation results of the 1980 and 1990 static models (Table 4.10).

Manufacturing employment was not significant in either the OLS regression or the SEM for the 1980 static model. In the single structure variable models (Table 4.4, p. 110), the 1980 manufacturing employment level was positive in both estimation methods. In the full structure variable model, on the other hand, the coefficients of the manufacturing employment levels were negative in the OLS regression but were positive in the SEM. The distributional effect of the 1980 manufacturing employment level was not conclusive in the region. Thus, this research failed to find statistical association between manufacturing employment and income inequality level in the region. The level of manufacturing employment was not an associated with income inequality in the region in 1980.

Table 4.10 Full 1980 and 1990 Static Models

	1980 Static (without Retail+Service)				1980 Static (without Manufacturing)				1990 Static (without Retail+Service)				1990 Static (without Manufacturing)			
Dep. Var.	GINI_79				GINI_79				GINI_89				GINI_89			
Model	OLS		SEM		OLS		SEM		OLS		SEM		OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	52.118	0.009	23.752	0.166	49.910	0.013	23.411	0.172	71.007	0.000	58.983	0.002	98.233	0.000	72.736	0.000
MANU	-0.009	0.800	0.000	0.994					0.273	**0.000**	0.164	**0.000**				
RSVC					0.045	0.374	0.009	0.833					-0.310	**0.000**	-0.179	**0.000**
TREMP	-0.184	**0.024**	-0.206	**0.003**	-0.208	**0.013**	-0.211	**0.003**	0.066	0.478	0.108	0.157	0.068	0.477	0.099	0.193
TFIRM	0.352	**0.000**	0.320	**0.000**	0.338	**0.000**	0.317	**0.000**	-0.356	**0.006**	-0.342	**0.002**	-0.313	**0.018**	-0.302	**0.006**
EINDX	-0.071	0.300	0.019	0.746	-0.077	0.262	0.016	0.783	0.110	0.191	0.018	0.782	0.091	0.286	0.005	0.944
FINDX	-0.644	**0.001**	-0.320	**0.057**	-0.643	**0.001**	-0.319	**0.058**	-0.578	**0.005**	-0.263	0.188	-0.625	**0.003**	-0.256	0.202
EMPDEN	0.002	0.247	-0.003	**0.054**	0.002	0.250	-0.003	**0.054**	-0.004	0.829	-0.002	0.143	-0.001	0.800	-0.003	**0.092**
EDUMID	0.460	**0.000**	0.349	**0.001**	0.488	**0.000**	0.355	**0.001**								
EDUHI	0.482	**0.000**	0.451	**0.000**	0.484	**0.000**	0.450	**0.000**	0.961	**0.000**	0.796	**0.000**	1.003	**0.000**	0.824	**0.000**
EDCX	0.064	0.157	0.029	0.479	0.060	0.188	0.028	0.493	0.112	**0.033**	0.079	**0.063**	0.098	**0.067**	0.063	0.137
HWAYX	-0.150	**0.038**	-0.050	0.465	-0.157	**0.029**	-0.053	0.433	-0.005	0.963	-0.018	0.830	-0.053	0.604	-0.075	0.348
PC_LAND	-1.224	**0.001**	-1.686	**0.000**	-1.245	**0.001**	-1.689	**0.000**	-2.239	**0.000**	-0.465	0.414	-2.232	**0.000**	-0.595	0.296
PC_RIVER	1.020	**0.002**	1.103	**0.000**	1.034	**0.002**	1.107	**0.000**	-0.836	**0.050**	-0.383	0.306	-0.921	**0.033**	-0.571	0.124
PC_LAKE	0.395	0.211	0.083	0.786	0.392	0.213	0.086	0.778	-0.368	0.370	-0.272	0.461	-0.299	0.474	-0.192	0.604
PC_WARM	-1.592	**0.000**	-1.308	**0.000**	-1.593	**0.000**	-1.308	**0.000**	-1.274	**0.007**	-0.400	0.304	-1.167	**0.015**	-0.344	0.377
PC_COLD	-0.502	0.121	-0.718	**0.010**	-0.523	0.107	-0.722	**0.010**	0.209	0.625	-0.036	0.917	0.343	0.428	0.074	0.832
F-value	15.35	**0.000**			15.45	**0.000**			38.1	**0.000**			36.62	**0.000**		
Adj. R^2	0.473				0.475				0.684				0.675			
White test	102.77	0.982			99.97	0.99			110.58	0.697			126.91	0.293		
Moran's I	0.218	**0.000**	-0.013	0.814	0.213	**0.000**	-0.013	0.814	0.256	**0.000**	-0.042	0.330	0.281	**0.000**	-0.045	0.297

Note: Bold p-values indicate that their corresponding variables are significant at p<0.1.

The effects of the 1990 manufacturing employment level on income inequality appeared to be consistent. The 1990 manufacturing employment levels were positive and significant in both estimation methods (Table 4.10). The 1990 manufacturing employment levels were positive and highly significant in the single structure variable models (Table 4.4, p. 110).

Thus, in 1990, a county with more manufacturing employment tended to have higher income inequality. That is, manufacturing employment was a disequalizing indicator in the region. This suggests that job quality and wage premium of the manufacturing sector may have diminished in the region in 1990.

The 1980 retail+service employment levels were not statistically significant in either the single structure variable models (Table 4.5, p. 112) or the full structure variable models (Table 4.10). The 1990 retail+service employment level was highly significant in both estimation methods for both the single and the full structure variable models. The signs of the 1990 retail+service employment level were negative in both the OLS regression and the SEM. In addition, the sign change from positive for the 1980 retail+service employment level to negative for the 1990 level seemed to be consistent in both the single structure variable models (Table 4.5, p. 112) and the full structure variable models.

Neither manufacturing nor retail+service employment had statistically significant evidence for distributional effects on income inequality in the region in 1980. However, manufacturing employment had consistently positive association with income inequality in 1990 in both estimation methods. This finding suggests that contrary to conventional wisdom, the manufacturing sector was a disequalizing factor in the region.

The 1990 retail+service employment level had negative coefficients in both estimations in both the single and the full structure variable models. This finding on the level retail+service

employment suggests that the retail+service sector tended to contribute to lowering income inequality. Although the retail+service sector was not statistically associated with income inequality in 1980, its equalizing contribution to income inequality became statistically significant in the region in 1990. Overall, the manufacturing sector played a disequalizing role but the retail+service sector had a significant effect on equalizing income distribution in the region in 1990.

The 1980 tourism-related employment level was negative and significant in both estimations. The estimation results of the full structure variable (Table 4.10, p. 124) models were quite different from those of the single structure variable models (Table 4.6, p. 115). The 1980 tourism-related employment level was not significant in either estimation of the single structure variable models. The 1990 tourism-related employment level was not significant in either of the estimations of the single and the full structure variable models. The signs of tourism-related employment were not consistent in either the single or the full structure variable model. The coefficients of tourism-related employment were negative in the single structure variables model but became positive in the full structure variable models in 1990. That is, the significances and signs of the 1980 and the 1990 tourism-related employment levels were not consistent across different estimation methods and specifications. This research, thus, failed to find a conclusive statistical effect of tourism-related employment on income inequality in the 1980s.

The 1980 level of tourism-related firms had significantly positive association with income inequality both in the full structure variable models (Table 4.10, p. 124) and in the single structure variable models (Table 4.7, p. 117). This finding suggests that in 1980, tourism-related firms might have contributed to an increase in income inequality in the region. However, the

positive association of tourism-related firms with income inequality did not continue in 1990. The 1990 level of tourism-related firms was positive and highly significant to income inequality in the full structure variable models. The sign change from positive in 1980 to negative in 1990 was likely to be consistent both in the single (Table 4.7, p. 117) and in the full structure variable models (Table 4.10) across both estimation methods.

These findings suggest that the level of tourism-related firms have been a disequalizing factor in the region in 1980 but it had the opposite relationship with income inequality in 1990. That is, tourism-related firms contributed to increasing income inequality in 1980 but to decreasing income inequality in 1990. The consistent negative signs of the 1990 tourism-related firms suggest that tourism-related firms might contribute to decreasing income inequality.

Employment diversity index levels in the full structure variable models (Table 4.10) were not significant in either estimation approach. The 1980 OLS regression model was negatively significant in the single structure variable models (Table 4.8, p. 120) but became insignificant in the full structure variable models. The 1990 level of the employment diversity index was consistently positive but insignificant in both the single and the full structure variable models. Thus, the levels of the employment diversity index failed to provide statistical evidence for an association with income distribution.

Both in the single structure variable models (Table 4.9, p. 122) and in the full structure variable models (Table 4.10), the 1980 level of firm diversity index had negatively significant association with income inequality in both estimation methods, implying that a county with a more diverse firm structure was likely to have lower income inequality. The 1990 level of the firm diversity index showed statistical evidence for its association with income inequality in the OLS regression models but not in the SEMs. In 1980, the level of firm diversity tended to be an

equalizing determinant for income distribution in the region. Although the 1990 level of firm diversity had negative coefficients across both estimations, the relationship between firm diversity level and income inequality level was not conclusive.

In the full structure variable models, the change models between 1980 and 1990 were assessed in relation to manufacturing, retail+service, and tourism-related employment, tourism-related firms, and firm diversity variables to represent economic structure (Table 4.11). The employment diversity index variable (EINDX) was dropped because of its high correlation (r = –0.67) with the tourism-related firm variable (TFIRM). Both the OLS regression and the SEM models consistently had the same signs. Of the five structural variables, only one showed marginally statistically significant association with the change in income inequality in the OLS model. That was tourism-related employment. Tourism-related employment, however, was not statistically significant in the SEM. Thus, this research failed to find any robust and consistent statistical association between economic structure and income distribution in the three states during the 1980s.

Many hypothesize that economic restructuring causes income inequality because manufacturing employment equalizes income distribution while service jobs increase income inequality (Nielsen and Alderson 1997; Lobao et al. 1999; Morris and Western 1999; Chevan and Stokes 2000). The change models of the full structure variable models showed that although it was not statistically significant, change in manufacturing employment had a negative association with change in income inequality in both estimation methods from both the single (Table 4.4, p. 110) and the full structure variable models (Table 4.11). That is, the manufacturing sector might still have an equalizing effect on income distribution but the effect

Table 4.11 Full Structure Variable Models of 1980-1990 Change

	1980 – 1990 Change			
Dep. Var.	GINI_79-89			
Model	OLS		SEM	
Variable	$\hat{\beta}$	p-value	$\hat{\beta}$	p-value
Intercept	24.262	0.000	24.353	0.000
MANU	-0.023	0.113	-0.014	0.257
RSVC	0.042	0.536	-0.003	0.965
TREMP	-0.027	**0.085**	-0.018	0.167
TFIRM	0.006	0.900	0.051	0.279
EINDX				
FINDX	0.323	0.100	0.018	0.928
EMPDEN	0.061	**0.019**	0.037	0.137
EDUMID	-0.220	**0.002**	-0.323	**0.000**
EDUHI	-0.020	0.702	-0.010	0.828
EDCX	0.103	**0.001**	0.066	**0.016**
HWAYX	-0.009	**0.001**	-0.004	0.119
PC_LAND	-1.944	**0.001**	-0.386	0.585
PC_RIVER	-2.345	**0.000**	-1.414	**0.005**
PC_LAKE	-1.332	**0.007**	-0.857	**0.073**
PC_WARM	-0.835	0.120	-0.114	0.817
PC_COLD	0.003	0.995	0.189	0.671
F-value	8.910	**0.000**		
Adj. R^2	0.332			
White test	119.21	0.832		
Moran's I	0.225	**0.000**	-0.028	0.542

Note: Bold p-values indicate that their corresponding variables are significant at $p<0.1$.

was not statistically significant. The change coefficients of retail+service employment were not statistically significant in both estimation methods in the full structure variable model (Table 4.11). In the single structure variable models (Table 4.5, p. 112), the change coefficients of retail+service employment had positive signs. Their signs were not consistent across estimation methods. The change coefficient of retail+service employment was positive in the OLS regression but negative in the SEM. Several different model specifications also showed inconsistent signs of the change in retail+service employment. Thus, this research found no conclusive evidence of the distributional effects of the retail and service sector in the region during the 1980s.

The change in tourism-related employment was negative and marginally significant ($p<0.1$) only in the OLS regression model. This suggests that tourism-related employment growth tended to contribute to equalizing income distribution in this region during the 1980s. While the retail+service sector did not have evident effects on income distribution in the region, tourism-related employment growth showed marginal effects on equalizing income distribution in the region during the 1980s. The negative association of tourism employment growth with income inequality suggests that the tourism sector not only stimulates economic growth but also contributes to equalizing income distribution.

However, the changes in tourism-related employment were not significant in the SEM even though its signs were positive in both the OLS regression and the SEM. The SEM result suggests that the statistical significance of tourism-related employment resulted from the inability of the OLS regression to take into account spatial dependence, especially in the residuals. Thus, the policy implication of tourism-related employment growth from the OLS regression may not be valid.

According to the results of the SEM, this research cannot suggest that economic restructuring had statistical association with income distribution in this region. Nor can it suggest that the growth of retail+service employment caused income inequality during the 1980s. Furthermore, this research cannot support the argument that tourism development contributed to equalizing income distribution.

Given that the traditional regression estimation and the relatively new spatial econometric approach provided clearly different results, this research demonstrated that if spatial processes were not appropriately controlled, they could lead to incorrect policy implications. This has important implications for regional scientists who deal with spatial data. Regional policy analysis cautions against ignoring the assumption violations of traditional regression analysis, especially the non-zero spatial autocorrelation assumption violation.

The Distributional Effects of Endogenous Growth Variables

This research tested the hypothesis that popular endogenous growth engines might affect income distribution. This research employed three endogenous variable groups to represent growth engines: market size and structure, human capital, and public investment. In this research, the selected variables of endogenous growth engines were extensively tested with different model specifications.[5] Overall, the selected endogenous growth variables were consistent across different model specifications.

This research used employment density to measure market size. Endogenous growth models employ a market size measure to capture economies of scale, agglomeration effects, or

[5] The share of people with high school diploma (EDUMID) was dropped in the 1990 static model specifications due to its high correlation ($r = -0.71$) with the share of people with people with college degree and higher (EDUHI).

knowledge spillovers of economic activities including technical innovation. Endogenous growth models assume that economies with a large market size and, especially, a large stock of educated human capital may grow faster. A certain level of market size is necessary to recuperate the fixed setup costs of innovations and to enjoy sufficient short-term rents from innovation. Market size also represents the potential to create new innovative ideas from the frequent interactions of diverse people with ideas and skills. Endogenous growth models generally measure market size with population density. This research, however, measured market size by employment density that was assumed to capture people who actively participate in production and innovation. This research, then, hypothesized that as market size increases and innovation potential also increases, the monopolistic rents are disproportionately distributed to a certain class of people who have inventive ideas and capital, leading to increased income inequality.

The coefficient of employment density in 1980 had significant positive association with income inequality in the OLS regression of all single structure variable models except the single firm diversity index models (Table 4.9, p. 122). The coefficient was negative and insignificant in the 1980 static SEM models. Only in the firm diversity index models was the 1990 employment density negatively associated with income distribution. Throughout the single structure model specification, the 1990 employment density variable was insignificant with positive signs in the OLS regressions and negative signs in the SEMs. The change in employment density was positively associated with income inequality in the OLS regression but was not significant in the SEM in any of the single structure variable models.

Unlike most single structure variable models, the 1980 full structure variable models had a negative association with income inequality in only the SEMs. This finding implied that a county with higher employment density tended to have lower income inequality. This

implication, however, did not gain support from the 1990 full structure variable models. Employment density was not significant in the 1990 static model (without retail+service) in either estimation. In the 1990 static model (without manufacturing), the variable was negatively significant ($p<0.1$) only in the SEM specification.

An interesting note is that the level of employment density during the 1980s had consistently negative signs throughout different SEM specifications. The consistent negative sign of the level of employment density was opposite to this research's hypothesis on the distributional effect of employment density. This finding suggests that a county with higher employment density tended to have more equal income distribution. This finding, however, was supported by the change model of employment density.

Both in the single and the full structure variable models, the coefficient of the change in employment density had consistently positive association with income inequality in the OLS regression. This OLS result showed that the rapid growth in employment density might have had a disequalizing effect on income distribution in the region during the 1980s. Although the coefficient of the change in employment density remained positive, it was not significant.

Overall, this research failed to find consistent distributional effects of employment density from either the static or change model specifications. The signs and significances of employment density changed by time period, model specification, and estimation method. One note is that the change in employment density was highly significant and positive in the OLS specification but was not significant in the SEM specification. Thus, the results from the OLS specification might be attributable to a possible spatial process and could have led to mistaken policy implication.

Endogenous growth models emphasize an economy's stock of educated human capital that can be contributed to create technical innovation. The models argue that an economy with a large stock of educated human capital can grow faster. In addition to the scheme of the endogenous growth framework, this research differentiated human capital into two subgroups in an endogenous growth framework. The first group was unskilled human capital that was devoted to final production systems. The second group was skilled human capital that was devoted to innovation. Then, this research hypothesized that skilled human capital was in a better position to take advantage of new innovations. The skilled human capital group could disproportionately enjoy monopolistic rents of new innovations, leading to income inequality. This hypothesis is also consistent with the argument of Morris and Western (1999) that the premium of high school education decreased, while the college education premium grew rapidly during the last two decades. This research employed high school education for unskilled human capital and college education for skilled human capital.

The level coefficients of both high school graduates and college graduates were generally positively associated with income inequality. Their signs and high significances were very consistent across different model specifications and estimation methods as well as over the research periods. This finding suggests that a county with either higher high school graduates or higher college graduates tended to have higher income inequality.

This finding supports the argument that educational premiums between high school graduates and college graduates have become greater since the mid 1980s (Morris and Western 1999). As the U.S. economy has shifted toward information technology and the professional service sector, wages between high school and college-educated workers have become more

bifurcated. The relative educational premium of a high school diploma has decreased while that of a college diploma has increased.

The change in high school graduates was always negative and significant throughout different model specifications and across two estimation methods but the change in college graduates was not significant. Thus, a rapid growth of high school graduates might be an equalizing force in income distribution in the region. A growth of college graduates was not statistically associated with a change in income inequality.

This research found that although the high school graduates had a declining position in job markets, the rapid growth of this educational group might contribute to equalizing income distribution. This finding implies that although the wage premium for high school graduates decreased, a policy promoting high school education may still be effective for equalizing income distribution. This is probably true if coupled with policies that increase the demand for high-school educated workers. Educational policy-makers, however, should keep in mind that if the current trends of economic restructuring remain strong, demand for less-skilled workers would decline (Murphy and Welch 1993).

Innovation-based endogenous growth models emphasize the roles of governments in providing research and development (R&D) subsidies and to enforce intellectual property rights. Those roles are more relevant to a central government. The endogenous growth models also emphasize public investment for inducing rapid economic growth. The responsibility for economic development has recently shifted more to local governments. Local governments' public investment decisions can significantly affect economic growth and income distribution. The effects of public infrastructure investment on economic growth, however, have been the

subject of on-going debates (Andrews and Swanson 1995; Button 1998). Furthermore, the distributional effects of local governments' public investment decisions are not unknown.

This research differentiated local public investment decisions into direct and indirect productive investments (Barro 1990; 2000b). The direct productive investment was measured by the share of highway expenditure and the indirect productive investment by the share of educational expenditure. This research assumed that both productive investments could increases income inequality.

The association of educational expenditure with income inequality drastically changed between 1980 and 1990. The 1980 level coefficients of educational expenditure were not associated with income inequality throughout different model specifications and estimation methods. On the other hand, the 1990 level coefficients of educational expenditure were highly significant and positive. That is, a county with higher share of educational expenditure in local general expenditure was likely to have higher income inequality. The change coefficients of educational expenditure were positively associated with change in income distribution from both estimation methods, with exception in the SEM models of tourism-related firm and employment diversity index. The full structure variable model had a positive association of change in educational expenditure with change in income inequality. These findings imply that rapid increases in educational expenditure in a local government may have had a disequalizing effect on income distribution in the region during the 1980s. The disequalizing effect of educational expenditure growth suggests that a county with greater spending on education may have better position effectively to create or retain high-paying jobs than any other county with less spending on education, leading to income inequality in the region. Furthermore, a county with spending

more on education can provide a better educational environment for higher income families that are more interested in educating their children.

The level coefficients of the 1980 highway expenditure were not associated with income inequality in any of the single structure variable models except the tourism-related firm model. The 1980 full model had a negative association of the 1980 highway expenditure with income inequality only in the OLS specifications. The 1990 highway expenditure level had a negative association with income inequality in both estimations except the manufacturing employment models and the tourism-related firm models in the single structure variable model. This may indicate that direct productive investment of a local government might have decreased income inequality in 1990. The coefficients of the 1990 highway expenditure in the full structure model, however, were not significant even though they remained negative. The change coefficients of highway expenditure were consistently significant and negative in the OLS regression specifications from both the single and the full structure variable models. The coefficients, however, were not significant in the SEM specifications. Although the highway expenditure variable did not have consistent significance across model specifications and time periods, it seemed to be negatively associated with income inequality. This research found that indirect productive investment of local governments might increase income inequality, while direct productive investment in highway did not have statistical association with income distribution.

The Distributional Effects of Natural Amenity Attributes

This research evaluated whether natural amenities functioned as an endogenous growth engine in association with regional income distribution. A principal component analysis was employed to measure natural amenity attributes of five amenity groups: land-based, river-based,

lake-based, warm weather-based, and cold weather-based amenities. The SEM was used to account for the spatial characteristics of natural amenity distribution because natural amenities were space-specific and had clustered patterns.

The 1980 OLS specifications from the single and the full structure variable models showed that three of the five amenity variables were consistently associated with income inequality. These three were land- based, river- based, and warm weather-based amenity variables. While the land-based and warm weather-based amenity variables had negative coefficients, the river-based variable had positive coefficients. In the 1980 SEMs, these three amenity variables remained significant and the cold weather-based amenity variable also became significant. The land-based, warm weather-based, and cold weather-based variables were negatively associated with income inequality, while the river-based amenity variable was positive. A county with more land-based, warm weather-based, and cold weather-based natural amenities tended to have lower income inequality but a county with more river-based natural amenity seemed to have higher income inequality in the region in 1980.

One notable difference between the 1980 and 1990 models was that all of the natural amenity variables became negative in 1990. Their negative signs were very consistent across different model specifications. In the 1990 OLS models, the land-based, river-based, lake-based, and the warm weather-based amenity variables remained significant. The cold weather-based amenity variable was not significant. In the 1990 SEMs, however, all amenity variables retained the negative signs and only the river-based amenity variable was intermittently significant across different models. This inconsistency of significances across different estimation methods suggests that the spatial characteristics of the distribution of natural amenities may be critical and should, therefore, be accounted for.

The change coefficients of four natural amenity variables were negative associated with income inequality in the single structure variable models from the OLS regression specifications. The cold weather-based amenity variable was never significant. The SEM specifications showed that only the river-based natural amenity variable had consistently negative association with income inequality in the single structure variable models. In the full structure variable models, the change coefficients of only three amenity variables – land-based, river-based, and lake-based amenity variables – were negatively associated with income inequality in the OLS regression specifications. In the SEM of the 1980 – 1990 change, however, only the river-based amenity variable and the lake-based amenity variable were negatively associated with the change in income inequality. This result suggests that a county with more river- or lake-related natural amenities tended to equalize income distribution more rapidly than counties with lower river- or lake-related natural amenities.

The SEM confirmed the conventional perception that the Great Lakes states had ample water-related amenity variables. Furthermore, this finding suggests that these region-specific river- and lake-related amenities tended to contribute to decreasing income inequality. Thus, an economic development policy based on region-specific river- and lake-related amenities is likely to lead to a more equalized income distribution pattern in the region. Specifically, if more equalized income distribution is a policy objective, it would be effective to develop polices to improve accessibility to water-related natural amenities, promote the availability of those amenities, and attract investment capital from outside sources to develop water-related recreational facilities.

This research found important policy implications through examination of the distributional effects of natural amenities. First, this research showed that different types of

natural amenities had different distributional effects. This finding suggests that single index approaches may be inappropriate as a natural amenity measure for investigating the effects of various natural amenities. Second, this research showed that only water-related natural amenities had evident effects on income distribution in the Great Lakes region. That is, not all but some natural amenities have income distribution impacts. This result implies that natural amenities have not only growth but also distributional effects. Both effects must carefully be considered when policy makers intend to develop natural amenities as an economic develop alternative. Third, as expected, the results of the SEM differed from those of the traditional OLS regression. This highlighted the need to account for the spatial characteristics of natural amenities in order to have correct policy implications. Finally, supporting the argument that nonmarket uses of natural resources have been ignored in regional science (Marcouiller and Deller 1996), this research suggests a need to incorporate nonmarket aspects of natural amenities more directly into regional economic development planning.

CHAPTER 5

SUMMARY AND POLICY IMPLICATIONS

The Problem

After the process of income convergence in the U.S. following the end of World War II, the distribution of income has been diverging among people and between regions since the late 1970s and early 1980s. Recent increases in income inequality are not outcomes predicted by traditional neoclassical growth theory.

Much effort has been made to find and explain the causes of income inequality. Among many separate causes that contributed to the increase in income inequality, economic restructuring in the U.S. for the last two decades is believed to be a major factor.

The goal of this research was to search for a linkage between economic structure and income distribution and to enhance understanding of that linkage. Furthermore, while searching for the linkage, this research has made an effort to provide the distributional implications of specific economic sectors for market-based economic development and planning practice.

The Approach

This research employed endogenous growth theory to explain a spatially divergent pattern of income distribution and hypothesized that economic structure was associated with income inequality. To test the hypothesis, this research developed an extended endogenous growth framework that included endogenous growth engines such as population, human capital, public investment, and natural amenities. The framework also contained several economic

structure variables including manufacturing employment, retail+service employment, tourism employment and firms, and employment and firm diversity indices.

To examine the relationship between economic structure and income inequality, this research employed traditional regression estimation and a spatial econometric approach. This research used spatially aggregated data that contained geographical information. This research suggested that conventional Ordinary Least Squares (OLS) estimation was misleading with respect to policy implications because of its lack of control for spatial autocorrelation from geographic information. Specifically, this research extended a spatial error model (SEM) to take into account possible spatial autocorrelation of the errors in the specified empirical models in this research.

Economic Structure Variables and Income Inequality

A summary of the distributional effects of economic structure variables on income inequality appears in Table 5.1. Manufacturing employment had a disequalizing effect on income distribution in the region in 1990. Although some studies found no clear statistical association between manufacturing employment and income distribution (Chevan and Stokes 2000; Ngarambé et al. 1998), this research clearly showed that the manufacturing sector lost its income equalizing effects in this region, especially in 1990. The disequalizing effect of the manufacturing sector in the region did not support the conventional wisdom that manufacturing jobs necessarily led to equalization. This finding also suggests that high-paying manufacturing jobs might not be available or may have left this region. Instead, poor-quality jobs in the manufacturing sector remained and this may have contributed to disequalizing income

Table 5.1 Summary of the Distributional Effects of Economic Structure Variables on the Level and Change of the Gini Income Inequality Index

Single Model	1980 Static		1990 Static		80-90 Change	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
MANU	ns/+	ns/+	**s/+**	**s/+**	ns/-	ns/-
RSVC	ns/+	ns/+	**s/-**	**s/-**	ns/+	ns/+
TREMP	ns/-	ns/-	ns/-	ns/-	**s/-**	ns/-
TFIRM	**s/+**	**s/+**	**s/-**	**s/-**	ns/-	ns/+
ED_INDX	**s/-**	ns/-	ns/+	ns/+	ns/+	ns/+
FD_INDX	**s/-**	**s/-**	ns/+	ns/-	ns/+	ns/+
Full Model	**1980 Static**		**1990 Static**		**80-90 Change**	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
MANU	ns/-	ns/+	**s/+**	**s/+**	ns/-	ns/-
RSVC	ns/+	ns/+	**s/-**	**s/-**	ns/+	ns/-
TREMP	**s/-**	**s/-**	ns/+	ns/+	**s/-**	ns/-
TFIRM	**s/+**	**s/+**	**s/-**	**s/-**	ns/+	ns/+
ED_INDX	ns/-	ns/+	ns/+	ns/+	na	na
FD_INDX	**s/-**	**s/-**	**s/-**	ns/-	ns/+	ns/+

Notes: • This summary table was based on the consistency of the signs and significances of the variables across different model specifications.
- s indicates significant.
- ns indicates insignificant.
- + indicates a positive sign.
- – indicates a negative sign.
- na indicates "not available" in the models.

distribution in the region during the 1980s. Thus, economic development efforts emphasizing promotion and retention of industrial jobs should take into account job types and quality rather than aggregate employment.

This research found that retail+service sector employment did not have statistical association with income inequality in 1980 but had significantly negative association with income inequality in 1990. However, both the OLS and the SEM estimation methods supported the negative relationship between retail+service sector employment and income inequality in 1990. That is, a county with more jobs in the retail+service sector tended to have greater equal income distribution in the region in 1990. This finding, however, needs to be understood with caution. Most retail+ service sector jobs created during the 1980s are of such a poor quality that retail and service sector jobs may bring the overall income level down in a region, leading to equal income distribution.

On the other hand, the change in retail+service sector employment did not have statistical association with income inequality in the region during the 1980s. Although this region saw rapid growth of retail+service sector employment, the rapid growth did not impact income distribution in the region. This research suggests that although retail+service industries provided employment opportunities and income sources for many communities in the region in the 1980s, opportunities for the retail+service sector economic growth did not contribute to equalizing income distribution in this region.

An important note is that the distributional consequences of growth in the retail+service sector employment remain unclear in the region. The signs and significances of growth in the retail+service sector employment were not consistent across different specifications and estimation methods. The nature of retail+service sector jobs seemed to be complex in the region.

Thus, economic development efforts targeting the retail+service sector must be based on deliberate evaluations of distributional effects of specific retail+service sector employment opportunities.

Another note is that in the static models, both manufacturing and retail+service sector employment had highly significant associations with income inequality but the change models did not show the association between the two sectors and income inequality. The static models, thus, did not support the argument that economic restructuring had caused recent income inequality in the U.S. The change models in this research showed that economic restructuring, measured in changes of manufacturing and retail+service employment, was not statistically associated with income inequality in the region. This research failed to support the economic restructuring hypothesis on recent U.S. income inequality. This research, thus, failed to show the linkage between economic restructuring and income distribution in the region during the 1980s.

In addition, this research failed to find a robust distributional effect of tourism-related employment. The statistical results of tourism-related employment were not consistent in either estimation. The results also were different between the single structure variable models and the full structure variable models. This inconclusive nature of tourism-related employment may be related to the disclosure problem of tourism-related employment data. Furthermore, this research took the supply-side definition of tourism and subjectively specified tourism industries. Thus, tourism-related employment data could suffer from subjectivity.

The number of tourism-related firms tended to contribute to increasing income inequality in the region in 1980. In 1990, the number had a negative association with income inequality, indicating that tourism-related firmed might have equalizing income effects in the region. The change models of the number of tourism-related firms were not significant from either estimation

in either the single or the full structure variable models. This research found that the number of tourism-related firms decreased during the 1980-1990 period. This trend was not consistent with a common perception that this region might have increased tourism-related firms. Within this region, tourism-related firms might have experienced closings or consolidation. Finding the reasons of the decreasing trend of tourism-related firms in this region requires future work.

Although this region might have had economic growth in tourism-related industries during the 1980s, this research found no distributional effects from these industries in the region. The consistent negative coefficients of tourism-related employment might indicate that growth in the tourism sector tended to contribute to equalizing income distribution. This argument gained no robust statistical support from this research. The number of tourism-related firms tended to have equalizing income distribution effects in 1990 but the change models could not confirm its equalizing effects in the region. Thus, this research failed to find the linkage between tourism industries and income distribution in the region in the 1980s.

The level of employment diversity was significantly associated with income inequality only in the 1980 OLS regression. The levels of employment diversity did not have statistical association with income inequality in the 1990 models across the two estimation methods. In the change models, there was no statistical association of the changes in employment diversity with change in income inequality in the region in the 1980s. The 1980 OLS and SEM specifications found a negative association of the level of firm diversity with income inequality in the region. The 1990 models, however, failed to support consistently the negative association. The change models of firm diversity failed to find its association with income inequality in the 1980s.

This research assumed that during the 1980s, economic restructuring in the U.S. changed the extent of economic diversity in this region. The change in economic diversity was, then,

hypothesized to affect income distribution. This research, however, failed to uphold the hypothesis and thus, failed to find linkage between economic diversity and income distribution in the region in the 1980s.

Endogenous Growth Engine Variables and Income Inequality

This research hypothesized disequalizing effects of three groups of endogenous growth engine variables. A summary of the distributional effects of endogenous growth variables on income inequality appears in Table 5.2. The first endogenous group was employment density. The level of employment density did not have consistent signs and significances in the either the 1980 or the 1990 models. In both the single and full structure variable models, the change in employment density consistently had a positive association with income inequality only in the OLS regression, indicating that growth in employment density tended to increase income inequality in the region in 1980. This indication, however, could not be sustained in the SEM specification. This finding shows that the traditional OLS estimation method supported this research's hypothesis that employment density increased income inequality. After taking into account spatial autocorrelation in the error term, however, the SEM specification failed to support the hypothesis.

This researched employed a high school education attainment group as a variable for unskilled labor force. The 1980 level of high school graduates in a county was positively associated with income inequality in both estimation methods. The change in high school graduates consistently had a negative association with change in income inequality, indicating that high school education tended to contribute to equalizing income distribution in the region

Table 5.2 Summary of the Distributional Effects of Endogenous Growth Variables on the Level and Change of the Gini Income Inequality Index

Single Model	**1980 Static**		**1990 Static**		**80-90 Change**	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
EMPDEN	ns/+	ns/-	ns/+	ns/-	**s+**	ns/+
EDUMID	**s/+**	**s/+**	na	na	**s/-**	**s/-**
EDUHI	**s/+**	**s/+**	**s/+**	**s/+**	ns/(+ or -)	ns/(+ or -)
EDCX	ns/+	ns/(+ or -)	**s/+**	**s/+**	**s/+**	ns/+
HWAYX	ns/-	ns/(+ or -)	**s/-**	ns/-	**s/-**	ns/-
Full Model	**1980 Static**		**1990 Static**		**80-90 Change**	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
EMPDEN	ns/+	**s/-**	ns/-	ns/-	**s/+**	ns/+
EDUMID	**s/+**	**s/+**	na	na	**s/-**	**s/-**
EDUHI	**s/+**	**s/+**	**s/+**	**s/+**	ns/-	ns/-
EDCX	ns/+	ns/+	ns/+	ns/+	**s/+**	**s/+**
HWAYX	**s/-**	ns/-	ns/-	ns/-	**s/-**	ns/-

Notes: • This summary table was based on the consistency of the signs and significances of the variables across different model specifications.
- s indicates significant.
- ns indicates insignificant.
- + indicates a positive sign.
- – indicates a negative sign.
- na indicates "not available" in the models.

during the 1980s. This finding suggests that although recent economic restructuring may not provide more job opportunities for a labor force that has only a high school education, high school education could contribute to equal income distribution. Thus, an educational policy emphasizing high school education may affect income distribution in the region.

This research showed that the change in the mid-educational attainment group had consistently negative signs in the single and full structure variable models across two estimation methods. Unlike other studies that provided inconsistent findings on the distributional effect of education (Morris and Western 1999), this research clearly showed that growth in high school-educated workers contributed to equalizing income distribution in the region during the 1980s.

This research hypothesized that a skilled labor force disproportionately enjoyed economic rents from technical innovation, leading to income inequality. This research employed a college education group as a variable for skilled labor force. The levels of college graduates consistently had a positive association with income inequality, indicating that a county with a larger number of college-educated people tended to have higher income inequality in the 1980s. The change in college graduates, however, had no statistical association with change in income inequality during the 1980s. Overall, this research found that a rapid growth of the mid-educational attainment group tended to be related to more equalized income distribution in the region during the 1980s but that the growth of the high-educational attainment group did not have distributional effects.

This research differentiated public investment, as an endogenous growth variable, into indirect and direct productive public investment. From the general expenditure of a county government, educational expenditure was employed for indirect productive public investment and highway expenditure was used for direct productive public investment. The level of

educational expenditure had positive signs in both estimation methods throughout the level models except for its 1980 level in the single models. And the change in educational expenditure was positively associated with change in income inequality except for its change both in the tourism-related firm models and in the employment diversity models in the single structure variable model specifications. A rapid increase in educational expenditure might contribute to disequalizing income distribution in the region in the 1980s. This research argued that the disequalizing effect of more spending on education in a county might result from a better position of the county to create and hold more high-paying jobs or to attract higher-income families who are more willing to invest in educating their children.[1]

Highway expenditure had negative signs throughout different estimation methods and model specifications except for the 1980 SEM of the single structure model. Its consistently negative signs might indicate that direct productive investment of a county government tended to decrease income inequality in the region. This indication was true only in the 1990 static OLS model and in the change models from OLS regression specifications. Specifically, the change in highway expenditure was not statistically associated with income inequality in the SEM models. The direct productive public investment of a county government might have contributed to having an equalizing effect on income distribution in the region in 1980 but the effect might neither be strong enough to have any statistical significance nor be the result of spatial autocorrelation. The traditional OLS regression might have implied that a policy of influencing income distribution by employing highway expenditure would lead to equalizing income

[1] The positive association of educational expenditure on income distribution found in the research, however, should be understood with caution. Higher income inequality may lead a local government to increase expenditure to provide better educational opportunities for children from lower-income families. The higher costs of educational programs including human and physical educational resources for such children increase the educational expenditure of a local government.

distribution. The spatial econometric estimation method, however, showed that it might not be effective for a county government to affect income distribution through an endogenous growth variable, specifically through direct productive public investment.

Natural Amenity Attributes and Income Inequality

This research examined the distributional effects of natural amenities in the region (Table 5.3). In 1980, the levels of land-based and warm weather-based amenities seemed to have consistently equalizing income effects, while the levels of river-based amenities tended to have disequalizing income effects except for the levels of cold weather-based amenities. In the 1990 models, the levels of land-based, river-based, and warm weather-based amenity variables had negative associations with income inequality in the OLS models but none of the natural amenity variables were significant in the 1990 SEM specification. In the change models, land-based, river-based, and lake-based amenity variables were negatively significant in the OLS. Furthermore, after controlling for spatial autocorrelation in the error terms, the SEM models showed that the river-based amenity variable was only negatively significant in the single structure variable model and that both river-based and lake-based amenity variables were negatively associated with income inequality in the full structure model. This research clearly showed that during the 1980s, some natural amenities had income-equalizing effects in the regional economy.

This finding suggests that water-related amenities can be an engine of both economic growth and income equality in the region. Previous studies (McGranahan 1999; English et al. 2000; Deller et al. 2001) found that natural amenities significantly affected population, job, and

Table 5.3 Summary of the Distributional Effects of Natural Amenity Variables on the Level and Change of the Gini Income Inequality Index

Single Model	1980 Static		1990 Static		80-90 Change	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
PC_LAND	**s/-**	**s/-**	**s/-**	ns/-	**s-**	ns/(+ or -)
PC_RIVER	**s/+**	**s/+**	**s/-**	ns/-	**s/-**	**s/-**
PC_LAKE	ns/+	ns/(+ or -)	ns/-	ns/-	**s/-**	ns/-
PC_WARM	**s/-**	**s/-**	**s/-**	ns/-	ns/-	ns/-
PC_COLD	ns/-	**s/-**	ns/(+ or -)	ns/-	ns/+	ns/+
Full Model	**1980 Static**		**1990 Static**		**80-90 Change**	
Variables	**OLS**	**SEM**	**OLS**	**SEM**	**OLS**	**SEM**
PC_LAND	**s/-**	**s/-**	**s/-**	ns/-	**s/-**	ns/-
PC_RIVER	**s/+**	**s/+**	**s/-**	ns/-	**s/-**	**s/-**
PC_LAKE	ns/+	Ns/+	ns/-	ns/-	**s/-**	**s/-**
PC_WARM	**s/-**	**s/-**	**s/-**	ns/-	ns/-	ns/-
PC_COLD	ns/-	**s/-**	ns/+	ns/(+ or -)	ns/+	ns/+

Notes: • This summary table was based on the consistency of the signs and significances of the variables across different model specifications.
- s indicates significant.
- ns indicates insignificant.
- + indicates a positive sign.
- – indicates a negative sign.
- na indicates "not available" in the models.

income growth. Further, this research suggests that natural amenities may affect income distribution, especially leading to equalizing income distribution. This research, however, shows that not all but some natural amenities may influence income distribution.

Implications for Market-based Progressive Planning Practice

The objective of this research was to enhance understanding of the relationship between economic structure and income distribution by searching for linkages between them. Furthermore, this research sought to provide distributional implications for progressive market-based economic development planning that would influence income distribution through growth in targeted sectors. This research hypothesized that market-oriented sectoral economic development alternatives could influence income distribution.

This research tested the hypothesis that economic structure affects income distribution. However, no conclusive evidence was found on the relationship between economic structure and income distribution. A general conclusion is that the linkages between economic structure and income distribution are dynamic. The following are reflections on policy implications for communities and their economic development policy makers and planners to be used to influence income distribution through change in specific sectors.

This research showed that the linkage between economic structure and income distribution changed over time and differed among various sectors. Determining what constitutes the linkage may be a particularly complex task because economic structure and income distribution may be both a process and a result of changing economic environments nationally and internationally as well as locally.

The dynamic nature of the linkage between economic structure and income distribution suggests that considerable caution is needed in efforts to affect income distribution through influencing specific economic sectors. Communities and their economic development planners should be aware of the nature of currently evolving economic restructuring. Economic restructuring may be a process for creating more profits through flexible management and vertical disintegration (Barkley and Hinschberger 1992; Welch 1993; Fainstein and Fainstein 1989). Capital is highly mobile and moves where it can generate maximum profits. Mobile capital does not necessarily serve communities where it locates. Thus, communities or regions making economic development efforts must decide whether they are well-served by mobile capital relative to their own human, institutional, and environmental conditions.

This research found that manufacturing employment had disequalizing income effects in the region. This research, then, argued that manufacturing jobs did not have the traditional income-equalizing influence that conventional wisdom might suggest. This research also argued that traditional high-paying manufacturing jobs were not available or had left this region. This research suggests that economic development planners who focus on the manufacturing sector should base their decision-making on a concrete understanding of the distributional consequences that new manufacturing policy may have. Planners must be aware of the types and quality of manufacturing jobs that they may target.

The shift to a service-oriented economy in the U.S. has been perceived to increase income inequality because of the dualistic wage structure of the service sector coupled with its discriminating location patterns (Sassen 1990). Professional and producer service jobs with high earnings tend to be concentrated in major cities. Meanwhile, low-wage, low-skilled service jobs are located in non-metropolitan regions (Smith 1993-2). Within this study region, significant

efforts have been made to develop the retail and service sector, especially in rural counties that tend to have relatively equal income distribution. This research argued that the equalizing effect of retail and service sector jobs resulted from decreasing overall income level in a region. This argument, however, could not be supported by a dynamic model specification. This research, thus, found no clear effects of retail and service sector employment on income distribution. This research suggests that economic development efforts of the retail and service sector might not have much influence on income distribution in the region. The sector might not be yet matured enough to affect income distribution in the region. Thus, efforts to promote and retain retail and service industries should proceed with caution, especially in rural communities that are desperate to recoup the loss of manufacturing jobs or improve their relative income position. The growth of retail and service industries may bring poor quality jobs into these communities that may not enhance their economic well-being. Specifically, these communities need to take into account the nature and quality of retail and service jobs in terms of their distributional effects on the communities.

Tourism development has been claimed as an economic alternative for many communities. Tourism has become a large and fast-growing industry in terms of aggregate income and job growth. Meanwhile, some have expressed concerns about the distributional consequences of tourism-related jobs because of their lower job quality (Williams and Shaw 1988; Ashworth 1992; Tooman 1997; Marcouiller 1997). Others believe that the poor quality of tourism jobs may lead to greater income inequality, especially in rural communities (Smith 1989; Marcouiller and Green 2000).

This research found no support for clear effects of tourism jobs on income distribution in this region. Whereas tourism development may have clear effects on growth in population,

employment, and income, there is little evidence of impacts on income distribution, at least in this region. This research concluded that tourism industries in this region might have equalizing income-effects but the equalizing effect might not be strong enough to affect income distribution. This research suggests that efforts to influence income distribution through tourism development should be based on concrete understanding of not only its effects on income and employment growth but also its distributional effects.

Endogenous growth models tend to emphasize the size of an economy. The models suggest that bigger economies, such as urban economies, can be better off from agglomeration effects or spillover effects. And they also argue that bigger economies have higher innovation potential. Results of this research imply that as an economy gets larger, it tends to increase income inequality. This finding suggests that the benefits of endogenous economic growth may concentrate income in a few income classes. This finding further suggests that a policy of increasing the size of an economy may lead to rapid economic growth but not to equal income distribution. Specifically, economic policy makers and planners should be aware that population growth policy needs to balance between growth effects and distributional effects.

Results of this research suggest that a rapid growth of the high school education group contributed to equalizing income distribution in the region during the 1980s. Although the educational premium of high school-educated workers tended to be declining, this research showed that promoting high school education might still be an effective policy for equalizing income distribution in the region. However, educational policy may not be successful without a linkage to adequate industrial policy that could help increase demand for high school graduates. Although current economic structure requires high-skilled workers, careful design of industrial

policy focusing on demand for middle-skilled labor may have significant effects on income distribution.

This research suggests that counties with better educational environments can enjoy an advantageous status for high-paying jobs or higher-income families. The favorable educational environment may give these counties competitive advantage over other counties that may not have enough investment capital for education. Favorable counties may have cumulative effects of concentration of human and physical capital. Inequality between favorable counties and unfavorable counties tends to keep increasing. State or regional-level governments may need to develop programs that allow the lagging counties to provide better educational opportunities.

This research uniquely showed that natural amenity attributes could contribute to equalizing income distribution in the region. This research, however, argued that not all but some natural amenities might affect income distribution. Specifically, this research revealed that water-related amenities, a widely appreciated natural amenity attribute in the Great Lakes region, had significant income-equalizing effects in the region during the 1980s. This research, thus, suggests that communities or regions first should identify the unique natural amenities that can give them a competitive advantage and generate both growth and income distributional effects.

This research showed that different natural amenities exhibited different distributional effects. Furthermore, this research implies that the same types of natural amenities may have different distributional effects in different regions because natural amenities are region-specific. Thus, economic development planners need to set a clear distributional goal, to identify region-specific natural amenities that can serve the goal, and to be aware of the distributional consequences of natural amenity development.

Results of this research provided important methodological implications for policy research. This research demonstrated the advantage and usefulness of a spatial econometric approach for taking into account the spatial processes of regional data. Specifically, this research suggested specific descriptive tools for spatial patterns of the data: the exploratory spatial data analysis (ESDA), the local indicator of spatial association (LISA), the Moran scatterplot, and the spatial error model (SEM) can help policy research and development planning arrive at proper policy implications. This research showed that in the change models, employment density, highway expenditure, land-based amenities, and lake-based amenities had different significances between traditional OLS and SEM specifications. This research clearly demonstrated that traditional OLS estimation methods could lead to incorrect policy implications because it does not take into account the geographic processes that spatial data contain.

Research Limitations and Future Research Needs

The findings and the conclusions in this research need to be understood in light of the following research limitations. First, this research hypothesized that economic structure affects income distribution. The hypothesis, however, failed to reflect a possible simultaneous relationship between economic structure and income distribution. This research focused on the distributional effects of economic structure on income distribution but not on a possible effect of income distribution on economic structure. For example, high income inequality regions that usually have lower public investment capacity and less human capital may not be the destinations of new businesses or firms of high technical industries. Alternatively, their comparative advantage in factor input costs (such as land or labor) can be attractive incentives

for some industries to locate their firms and start new businesses in the regions. The relationship between economic structure and income distribution, thus, can be two-way.

The research framework in this study did not take into account the dynamic relationship between economic structure and income distribution. A future study on the relationship may need advanced analysis techniques to capture the dynamic relationship between economic structure and income distribution. One such technique is a systematic equation approach using two-stage least squares (2SLS). A significant problem is that a systematic equation approach is very difficult to perform within a spatial econometric framework (Kelejian and Prucha 1997, 1998).

This research concluded that the nature of the relationship between economic structure and income distribution could change over time because economic environments are dynamic. This temporal nature was not fully incorporated into the research framework. Although this research focused on a period when the U.S. economy began to change, the research period might not have been long enough to capture the true nature of changes in economic structure and income distribution. Thus, a study on the relationship between economic structure and income distribution may need to cover a longer time frame.

The study region of this research was limited to the 242 counties of Michigan, Minnesota, and Wisconsin. A study region is always unique because its natural endowments, human capital, institutional frameworks, and external environments are different from those of other regions. Thus, the relationship between economic structure and income distribution may vary across regions, depending on region-specific development characteristics and distinct economic bases. Therefore, an identified relationship between economic structure and income distribution from a

specific region is difficult to generalize. Future work is needed to examine the relationship of many alternative regional specifications.

This research represented a methodological advance in the development of regional models by employing a spatial econometrics approach. Specifically, this research assumed implicit spillover effects across space and employed the spatial error model (SEM) to incorporate a possible spatial autocorrelation through the errors. However, this research also showed that the spatial effects of economic structure and income distribution might be explicit and so alternative spatial econometrics models might be needed to control for these explicit spatial effects. An alternative model may be the spatial lag model (SLM), which controls for the spatial autocorrelation of a dependent variable. Another alternative to control for spatial autocorrelation may be a combination of the SEM and the SLM that allows researchers to control for the spatial autocorrelations of both a dependent variable and error terms (LeSage 1997; Anselin and Bera 1998).

One critical caveat of spatial econometric approaches regards the spatial neighbor weights matrix, which provides a unified approach to incorporating the spatial relationship among n areal units. A conventional method for storing and organizing the spatial relationship among the n areal units is to employ a binary matrix in which values are either 0 or 1. However, it is not certain that the conventional method can convey accurate spatial information of interested social and economic variables. Nor is it certain that the selected spatial neighbor weights matrix can correctly represent the extents of the spatial effects of the variables. Thus, the correct construction of a spatial neighbor weights matrix could be critical in a future study.

Most empirical studies suffer from problems regarding data quality and this research is not an exception. Data quality can be critical in examining the economic effects of tourism

industries and natural amenities. Tourism and natural amenity-based development have been highly acclaimed as economic alternatives; however, effective economic development policy or planning for tourism and for natural amenity-based development may not be constructed without consistent and correctly specified data. Specifically, systematic efforts are needed i) to overcome the disclosure problem of tourism-related employment, ii) to decide which industries are tourism-related, iii) to develop methods that are more scientific for estimating accurate tourism-related employment for only out-of-region tourism demand, iv) to construct an annual or decennial database to inventory national natural amenities, and v) to develop advanced theoretical methods for measuring natural amenity attributes.

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APPENDIX

Spatial Distributions of the Selected Five Natural Amenity Groups

The spatial distribution maps are based on the final scores from the principal component analysis (PCA) of the selected five natural amenity groups. The land-based natural amenity map shows the distribution of forest lands and open lands that may provide recreational opportunities. The map may confirm that the extensive national, state, and municipal forestlands in the northern counties of the region have ample land-based natural amenities (Figure A-1).

The river-based natural amenity map captures the river basins that have scenic and recreational values. Those river basins are usually located within the boundaries of the national forests. They are Manistee National Forest, Ottawa National Forest, and Hiawatha National Forest regions (MI); Superior National Forest and Chippewa National Forest regions (MN); Chequamegon National Forest and Nicolet National Forest regions (WI). However, the NORSIS data may not capture St. Croix National Scenic Riverway and Mississippi River basins which are the natural border line between MN and WI (Figure A-2).

The lake-based natural amenity map shows that lake amenities are clustered in the eastern Upper Peninsular counties and the northwestern counties along Lake Michigan in MI; the northern MN counties and the Twin Cities metro counties have higher lake amenities; in WI, the lake amenity clusters are detected in Bayfield county, Vilas and Oneida counties, Door and Kewaunee counties, and the neighboring counties (Winnebago, Calumet, Green Lake) of Lake

Winnebago. The lake-based natural amenity map represents pretty much correctly the spatial distribution of lake-related amenities in the region (Figure A-3).

The warm weather-based natural amenity group tries to capture the relative size of human developed amenities such as swimming pools, tennis courts, golf courses, and play and campgrounds. This region is knows as having long and harsh winter. But the warm weather-based natural amenity map shows that the northern counties of this region also have relatively higher warm weather-base amenities. The cluster of Sauk, Columbia, Adams, and Marquette counties (WI) may indicate the Wisconsin Dells recreational region (Figure A-4).

The cold weather-based natural amenity group captures skiable acres, high snow acres, and snowmobiling trails in the region. The cold weather-based natural amenity map shows that the northern counties of this region have higher cold amenities. And the cold amenities are also detected in the Twin Cities metro counties, the Madison metro counties, the Milwaukee metro county, and the Detroit metro counties (Figure A-5).

Figure A-1 Spatial Distribution of Land-based Natural Amenity

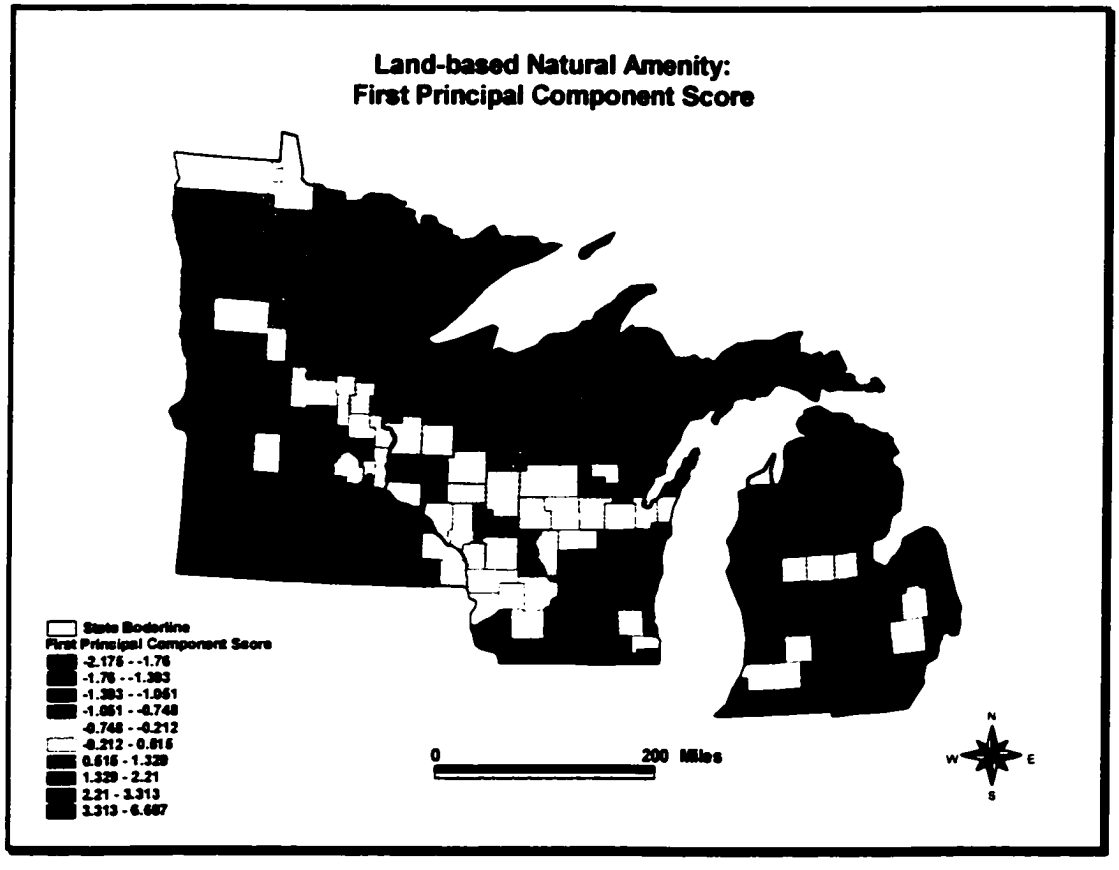

Figure A-2 Spatial Distribution of River-based Natural Amenity

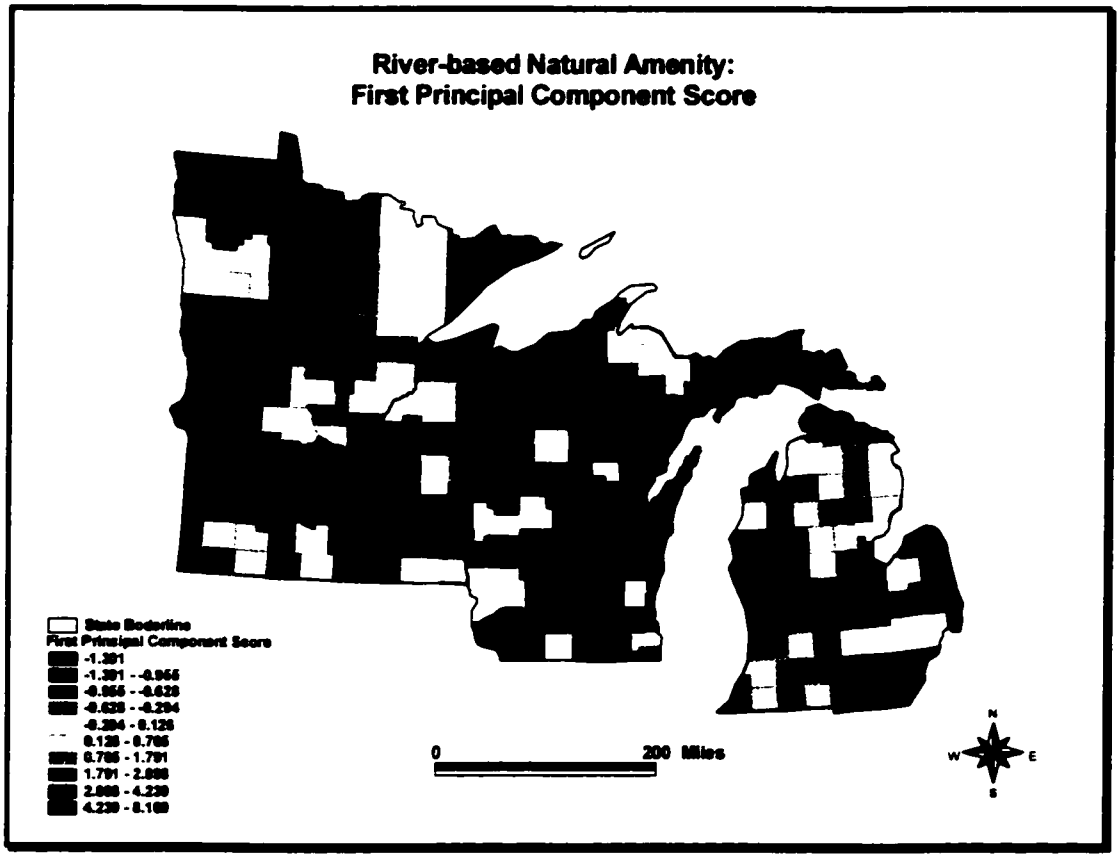

Figure A-3 Spatial Distribution of Lake-based Natural Amenity

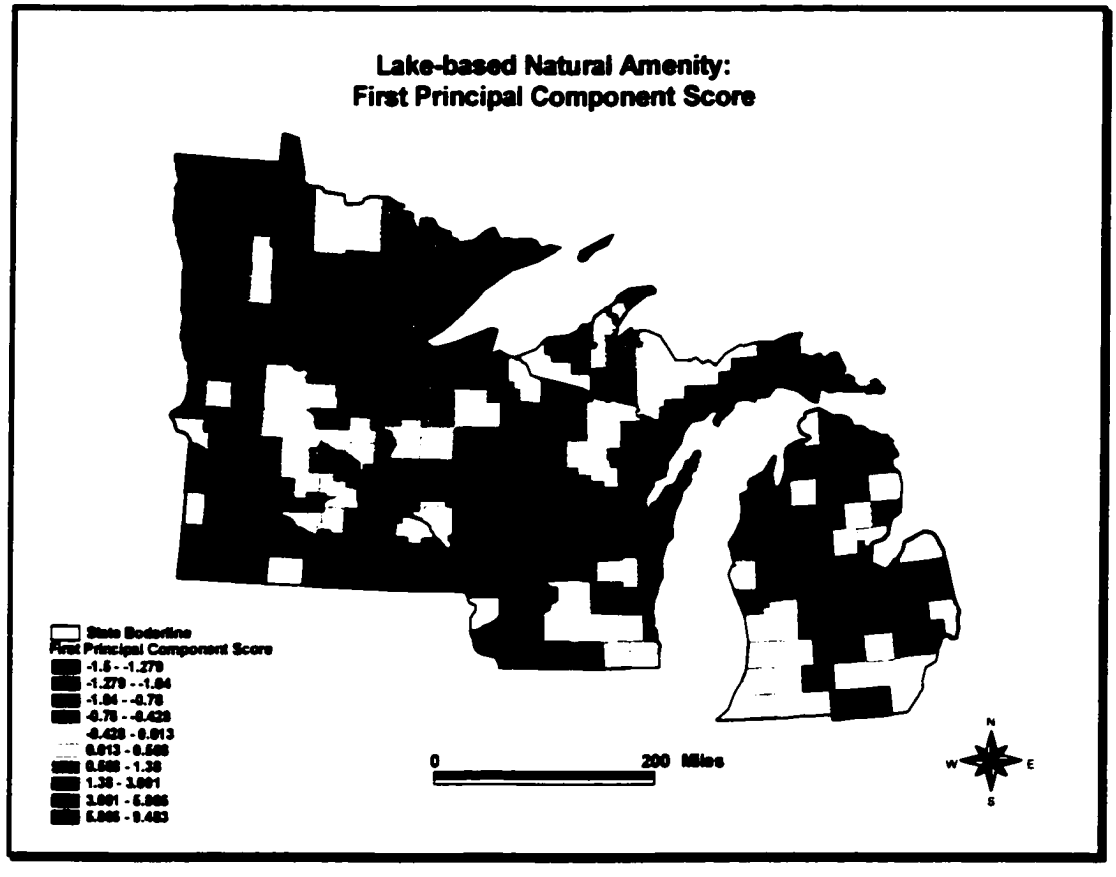

Figure A-4 Spatial Distribution of Warm Weather-based Natural Amenity

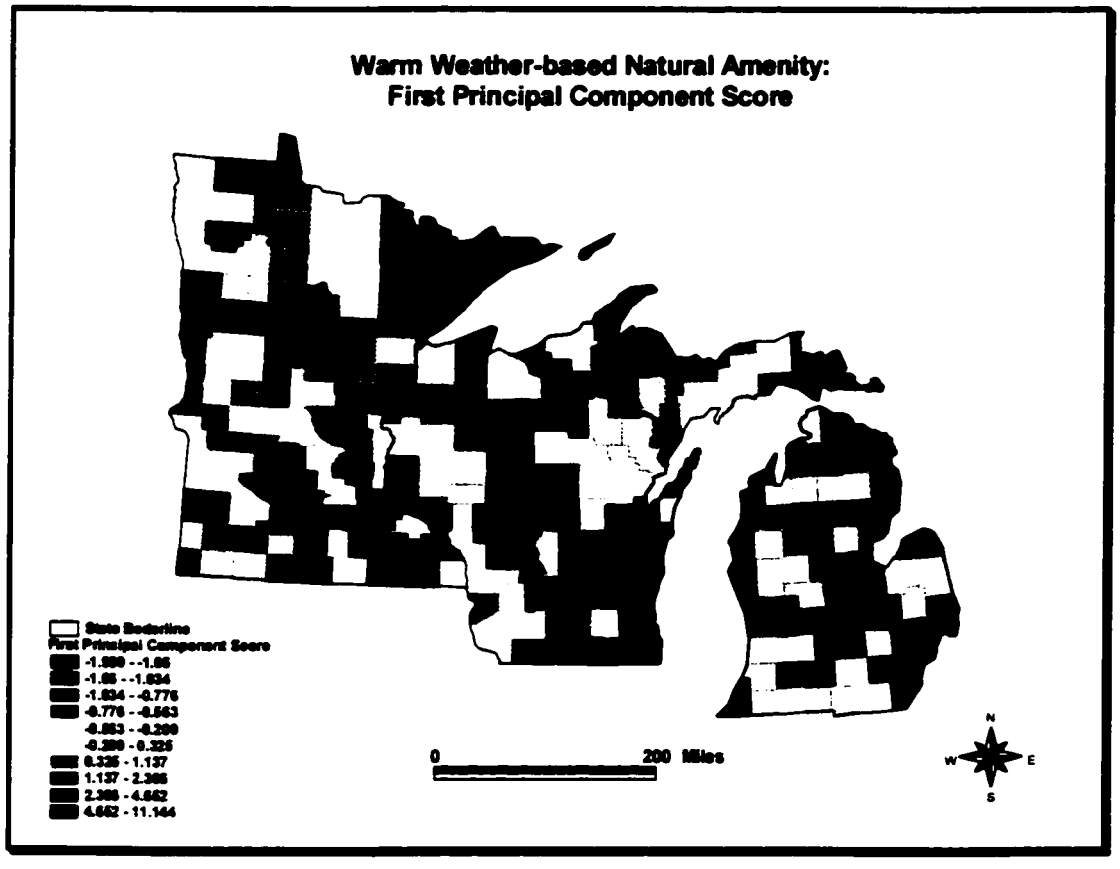

Figure A-5 Spatial Distribution of Cold Weather-based Natural Amenity