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SOCIOECONOMIC DEVELOPMENT IN THE SOUTHEAST REGION OF THE UNITED STATES FROM 1995 - 2000: A STRUCTURAL EQUATION MODELING AND A GIS MODELING APPROACH

By

Erdenechimeg Eldev-Ochir

A Dissertation
Submitted to the Faculty of
Mississippi State University
In Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in Applied Economics
in the Department of Finance and Economics

Mississippi State, Mississippi

December 2007

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2007

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By

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Candidate for Degree of Doctor of Philosophy in Applied Economics

This research presented in this study demonstrates that county level population growth, economic growth, and localized social structure are interrelated. An analysis of the spatial distribution of these factors in the Southeast Region of the United States during the period of 1995-2000 also indicates the importance of differences in rural versus urban and coastal versus non-coastal areas as well as the importance of such factors as highways, large cities, and universities in economic, population, and social structure interrelationships. An extensive dataset is used in the analysis as a number of analysis tools including statistical analysis, econometric models, spatial econometric models, structural equation models, and GIS mapping.

DEDICATION

I would like to dedicate this work to My Mother, Natsagdorj Sandagdorj, and to My Father, Eldev-Ochir Genen, PhD.

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I would like to acknowledge many people for their support during my doctoral program at Mississippi State University. I would especially like to thank my advisor, Dr. Charles A. Campbell, for his excellent guidance, patience, time, and commitment. Throughout my doctoral program, he advanced my independent thinking and research skills to greater heights. He also continually stimulated my analytical thinking and greatly assisted me in learning the scientific writing process.

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ACRONYMS

Acronym	Meaning
ANOVA	Analysis of Variance
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BLUE	Best Linear Unbiased Estimator
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
EQS	Equations (Structural Equation Modeling Software)
ESRI	Environmental System Research Institute
FIPS	Federal Information Processing Standards
GDP	Gross Domestic Product
GIS	Geographic Information System
GSP	Gross State Product
HDI	Human Development Index
LISA	Local Indicators of Spatial Autocorrelation
LISREL	Linear Structural Relations (Structural Equation Modeling and Multilevel Software)
MCNC	Microelectronics Center of North Carolina
MSA	Metropolitan Statistical Area

Acronym	Meaning
NOAA	National Oceanic and Atmospheric Administration
NAD	North American Datum
NCREN	North Carolina Research and Education Network
REIS	Regional Economic Information System
RUC	Rural Urban Continuum
SEM	Structural Equation Model
SMSA	Sphere of Metropolitan Statistical Areas
SPSS	Statistical Package for the Social Sciences
U.S.	United States
U.S.A.	United States of America
UNDP	United Nations Development Programme

CHAPTER I

INTRODUCTION

The primary relationships among the elements that determine the socioeconomic health and development of a region are complex and interrelated. Socioeconomic development is used here to include population growth, economic growth, and social development. Population growth can arise from increased births, decreased deaths, or increased net in-migration. Economic growth is generally used here to include increases in per capita personal income, increases in employment growth, and increases in number of establishments. Social development includes such diverse elements as improvement in education and housing as well as progress in economic opportunity. Population growth, economic growth, and social development are all interrelated.

The primary research question investigated in this paper is the degree to which the components of socioeconomic development, and the relationships among those components, differed spatially in the southeast[1] region of the United States during the period of 1995-2000. Traditionally, spatial variation has primarily been examined in the context of urban and rural differences. Here, in addition to the urban-rural differentiations, the differences between coastal and non-coastal counties are also

[1] According to the regions classification of Bureau of Economic Analysis, the Southeast Region consists of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia. Virginia is not included in this study because of its unique city-county configurations and the fact that such data incontinuities are more likely to lead to ambiguity than clarification.

examined. The relevance of these differences has become more important in light of Katrina and other recent hurricanes. Understanding such differences can help to understand both the impacts of such disasters and how recovery may be affected. This study employs a collection of tools and techniques (statistics, econometric models, mathematical models, geo-techniques, and spatialized models) to understand and explain the relationships among social development, population growth, and economic growth and their interrelated roles in socioeconomic development.

The urban economists and regional scientists seek to identify the factors leading to the distribution of economic activity over space (Hoover, Edgar M. and Frank Giarratani, 1999). In this study, the spatial character of the Southeast will be examined through a framework that includes three primary research objectives stated in the form of:

1) Where was urban and regional socioeconomic development/growth concentrated in the Southeast region from 1995 to 2000; how did it differ between rural/urban and coastal/noncoastal areas?

2) What characteristics are most important to urban and regional socioeconomic development for the Southeast region?

3) What was the nature of the interdependent relationship between population growth and economic growth from 1995 to 2000 toward social development for 2000?

Estimates that are relevant to these questions are made using non-recursive structural equation modeling and GIS modeling analyzing approaches. GIS spatial analysis involves both GIS vector (spatial lag model) and raster models based on the results of the structural equation modeling.

In the vector data model, “an abstraction of the real world where positional data is represented in the form of co-ordinates” is defined (Antenucci, John C., et al., 1991). Vector data signifies features such as points, lines, and polygons. Vector data in GIS is more suited to discrete objects that specify defined shapes and boundaries. The features have a precise shape and position, attributes and metadata, and useful behavior. In the raster model, an “abstraction of the real world where spatial data is expressed as a matrix of cells or pixels, with spatial position implicit in the ordering of the pixels” (Antenucci, John C., et al., 1991). Raster data represents imaged or continuous data. Each cell (or pixel) in a raster is a measured quantity. The value associated with a cell defines the class, group, category, or measures at the cell position.

The study includes not only structural equation and GIS modeling, but also the use of descriptive statistics analysis, correlation analysis, cluster analysis, spatial statistics and spatial econometrics analysis. Cluster analysis includes multivariate analytical techniques that can be used to identify meaningful subgroups of individuals or objects. Subgroups are mutually exclusive groups based on the similarities of individuals or objects (Hair, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1984). Hierarchical cluster procedure, which involves the construction of a hierarchy or tree-like structure, is used for cluster analysis. An illustration of hierarchical clustering can be shown by a dendrogram.

Spatial statistics analysis can describe (i) the spatial distribution of features such as its center, compactness, orientation and direction; (ii) patterns that are constructed by features such as being completely centered or clustered at one focal point or scattered (random patterns), etc.; and (iii) location of the clusters, i.e. to map hot and/or cold spots

(Mitchell, Andy, 2005). However, spatial econometrics methods can engage in problems of spatial dependence (autocorrelation) and spatial heterogeneity, as well as their extensions to the space-time domain (Anselin, Luc, 1988). In other words, spatial econometrics investigate methodological relationships that pursue from the unambiguous deliberation of spatial effects (spatial autocorrelation and spatial heterogeneity) (Anselin, Luc, 2000). In this study, the Moran's I test specification and spatial lag model are used in the diagnostics for the presence of spatial effects or spatial dependence.

1.1 Background

From 1990 to 2000, the southeast region of the United States grew relative to the total U.S. population. During that time frame, the southeastern population as a percentage of the total U.S. population grew from 23.84% to 24.64% (U.S. Census Bureau, 2006). By 2004, the southeastern population constituted about 29 percent of the total population in the United States (U.S. Census Bureau, 2006). In the 1970s and 1980s, there was a change in migration patterns in which a rural–urban turnaround took place (Campbell, Charles A, 1985). Described migration patterns prior to the turnaround were dominated by rural to urban and south to north migration. Such migration tended toward areas of industrialized sectors. Prior to the turnaround, migration patterns were dominated by movement away from rural areas to urban areas and away from the south to northern manufacturing areas (Campbell, Charles A, 1985). During the 1990s and 2000s, the migration patterns once again influenced change in the South. Where the rate of return on capital is low, labor tends to migrate toward a high-wage region (Greenwood, Micheal G, 1981). This eventually caused labor demand to decline and led to excess

labor supply in the north. "Capital migrates to the low-wage region, where the rate of return on capital is high" (Greenwood, Micheal G, 1981). Given this, the South has a relatively lower wage than other regions. Therefore, entrepreneurs tend to invest their capital in the South, which leads to increased job opportunities and more possible migration. The Southeast region also contributes, on average, about 25 percent of the Real GDP of the U.S. and has been one of the fastest-growing regions during the last 15 years (U.S. Department of Commerce, Bureau of Economic Analysis 2006).

In order to analyze these remarkable socioeconomic changes and in order to answer "where, what, and why" questions about these socioeconomic changes in the Southeast region, a collection of analysis tools and models will be employed. Non-recursive structural equation modeling is the primary tool of investigation here. Such a structural equation modeling approach is more appropriate than other approaches - such as simple regression analyses because causal relationships and interdependencies cannot adequately be captured in simple regression analysis.

The non-recursive structural equation model for socioeconomic development will consist of three measurement models for economic growth and population growth from 1995 to 2000 and social development for 2000. A primary assumption in this analysis is that true measurements for socioeconomic development are always unknown; therefore, the analysis of socioeconomic development requires the use of latent variables. A latent variable is an abstract variable, which is itself indicated by a number of observed variables. There are numerous possible constructs (or components) of socioeconomic growth, and the latent variables for each construct vary in their degree of abstractness; since all of the underlying constructs are elements of socioeconomic growth, these latent

variables are interrelated. The structural equation model is used to provide estimates of the total and indirect effects of variables upon each other, while the output of a simple regression model would only give the direct effects of variables upon dependent variables. Another important characteristic is that structural equation models involve postulated causal effects between one latent variable and another.

The simultaneous relationship between population growth and economic growth on overall socioeconomic development in a regression analysis will cause simultaneity, endogeneity, and heteroscedasticity problems using the given data information. An advantage of structural equation modeling is its emphasis on covariances rather than individual cases. Individual cases that are outliers can be a problem in parameter estimation. Structural equation modeling minimizes the differences between the residual and the difference between sample and predicted covariances (Bollen, Kenneth A., 1989).

Latent factors will be used for population growth, economic growth, and for overall social development. Endogenous variables for the population growth factor are the average annual rate of change of total population density from 1995 to 2000, and in-migration and out-migration rates from 1995 to 2000[2]. Endogenous variables for the economic growth factor are the average annual rate of change of the total number of people employed, the average annual rate of change of per capita personal income, and the average annual rate of change of the total number of establishments (by employment size). Endogenous variables for social development for 2000 are the education

[2] "These migration data come from the Census 2000 long-form question on residence 5 years ago and contain the number of people who moved between counties. A data record was produced for every combination of county-to-county migration flows in the United States of at least one person between 1995 and 2000. Current county of residence is based on where the person was living on April 1st, 2000. Previous county of residence is based on where the person was living 5 years earlier" (U.S. Census Bureau, 2000)

dimension index, the economic opportunity index, and the housing dimension index for 2000[3].

Exogenous variables include:

(i) demographic characteristics: average of the annual ratio of number of births to number of deaths from 1995 to 2000, median age for 1995, and the ratio of percentage of other race population to percentage of white population for 1995;

(ii) social development level 1990: human development index for 1990, which is determined by indices of education dimension, the economic opportunity, and housing dimension for 1990;

(iii) urban transition characteristic: the average gravitation into the large cities, and dummy variables for rural-urban continuum (Average gravitation into the large cities is the relative strength of a bond between two places as determined by multiplying the population of large city A by the population of county B and then dividing the product by the distance between the two places squared.);

(iv) environmental characteristics: dummy variables for coastal states.

This study will be conducted in three main stages:

1) an investigation of the measurements of each factor/construct (economic growth from 1995 to 2000, population growth from 1995 to 2000, and social development 2000);
2) estimation of the full structural equation model I for the socioeconomic development of the Southeast region, analysis of the simultaneous

[3] Indices are calculated using Estrada's Method. (Estrada, Joselito K., 2005)

relationships among population growth, economic growth, and the social development and estimation of direct and indirect effects of the factors;

3) identification of the exogenous indicators in the full structural equation model II and estimation of the direct and indirect effects toward population and economic growth from 1995 to 2000 and social development for 2000.

The study will dynamically represent and model spatial relationships between these factors. GIS models will give additional insight and visualization of the result of the structural equation model and make the model more accurate. This, in turn, will make analysis and prediction of spatial patterns more accurate. Analyses of descriptive statistics, correlation, and clusters will also help to make the model more accurate.

1.2 Organization

Section I is an introduction which provides an overview of the Southeast region, and which identifies the problem, scope and limitations of the study, research questions, and hypotheses. Section II is a review of the literature related to the theory and methods used in this study. The variable and model specifications and methodology are described in Section III. Section IV discusses both statistical and spatial analyses on data characteristics. Section V consists of the findings of the analysis for hierarchical and spatial cluster analysis, structural equation modeling, GIS raster modeling, and spatial lag modeling. Finally, summary and conclusions are discussed in Section VI.

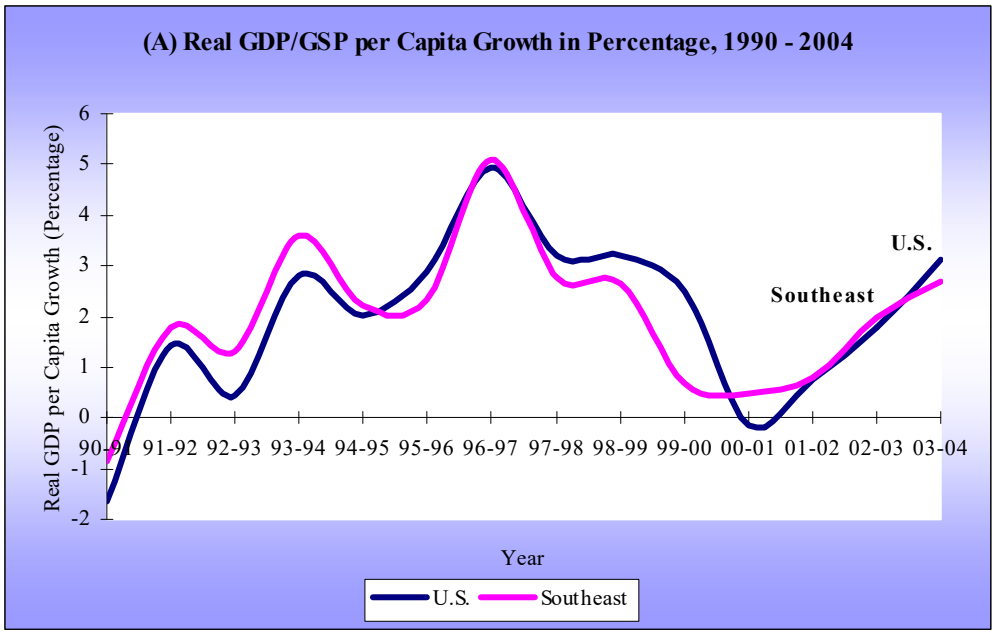
1.3 Southeast Region

According to the Bureau of Economic Analysis, the southeast region of the United States consists of the following twelve states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia. In 2004, these states constituted about 29 percent of the total population of the United States (U.S. Census Bureau, 2006). They contribute about 25 percent of the Real GDP to the United States and are considered one of the fast-growing regions (U.S. Department of Commerce, Bureau of Economic Analysis 2006). "A projected increase of 7.05 million jobs in this region from 1993 – 2005, mainly reflects above-average increase in jobs in construction and in most major private service – type industries" (Aman, Gerard P., George K. Downey and Sharon D. Panek, 2005). "By State, employment in Florida, Georgia, North Carolina, South Carolina, and Tennessee are projected to increase faster than the U.S. average; these states account for more than two-thirds of the projected increase in jobs in the region" (Aman, Gerard P., George K. Downey and Sharon D. Panek, 2005).

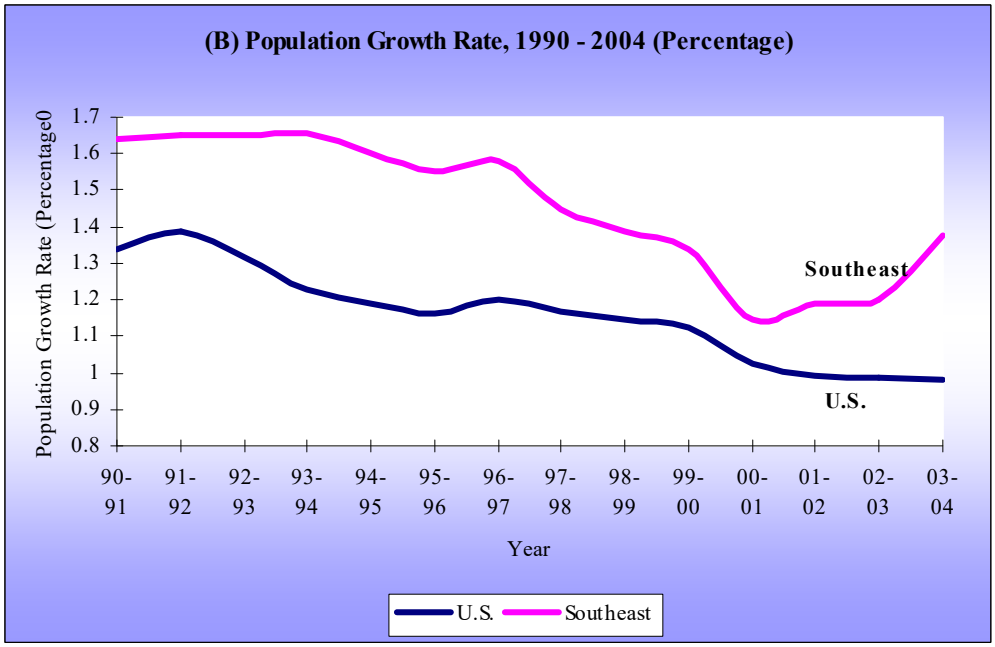
Total value of all final goods and services (GDP) is an extremely important measure of macroeconomic activity. Real GDP per capita (real GSP for state) is a single important measure of changes in individuals' well-being and changes in the standard of living of a nation. Economic growth represents the expansion of a country's real GDP per capita. Figure 1.1 illustrates the comparison between the United States and the southeast region in terms of the average income growth as measured by the growth rate for real GDP per capita and the GSP per capita, as well as the population growth rate from 1990 to 2004. On average, over this 14-year period, real GDP and real GSP have

grown by 1.98% and 1.99% per year, and they fluctuate simultaneously. During this period, the Southeast population growth per year is always higher than the United States population growth rate; on average the population growth per year for the United States is 1.16% and for the Southeast is 1.46%.

According to the Census of 2000, the South had both the highest in-migration and out-migration levels of the four regions (Northeast, Midwest, South, and West). "The resulting net-migration rate was 20.2 for the South, meaning that the South gained 20.2 people through migration for every 1,000 individuals living there in 1995" (Franklin, Rachel 2003). On average, the net-migration rate for the Southeast from 1995 to 2000 was 19.8, meaning that the Southeast gained 19.8 people through migration for every 1,000 individuals living there in 1995. In comparison, Florida had the highest net-migration (607,023) in the nation and Louisiana had lowest net-migration (-75,759) in the southeast region (U.S. Census Bureau, 2006). Figure 1.2 and 1.3 illustrate the South's population and its population growth rate from 1970 to 2000. Although the South's population has been increasing since 1970, the population growth rate has varied frequently.

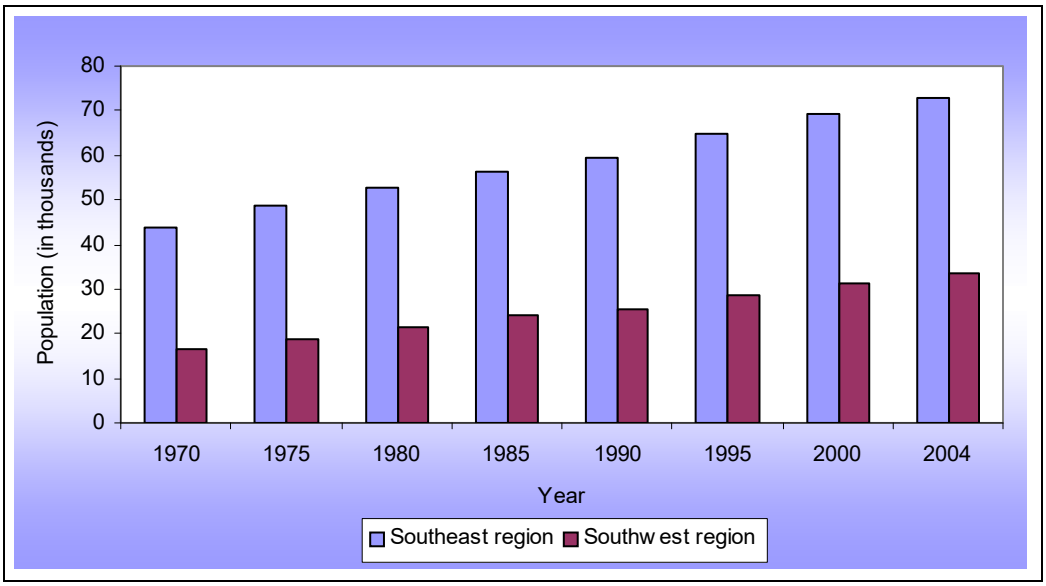


Source: Bureau of Economic Analysis, U.S. Department of Commerce



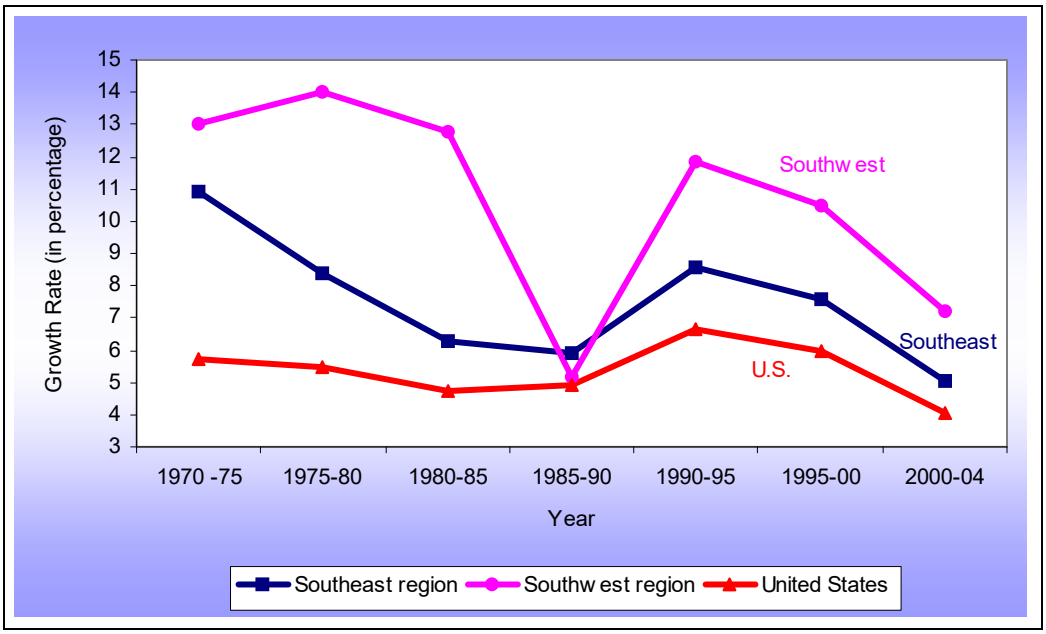
Source: U.S. Census Bureau

Figure 1.1 Real GDP/GSP Per Capita Growth and Population Growth in Percentage, 1990 – 2004



Source: U.S. Census Bureau and Bureau of Economic Analysis

Figure 1.2 Total Population of the South, 1970 – 2004



Source: U.S. Census Bureau and Bureau of Economic Analysis

Figure 1.3 Population Growth of the South, 1970 – 2004

According to the 1993 rural urban continuum code classification, among the total southeast region counties (excluding Virginia)[4], 26.9% are metropolitan counties, 49.3% are urban counties, and 23.8% are completely rural counties (U.S. Department of Agriculture, 2006). However, 66.5% of the total counties of the southeast region are the counties that have populations of less than 20,000 people. Compared to other regions of the United States, the southeast region seems more like a rural environment in which the main economic engine is agriculture; however, this is not true for today's era.

Evidence of the surge in growth in the South includes tourism and retirement in Florida; auto production facilities in Mississippi, Alabama, and South Carolina; high technology research facilities in North Carolina and Alabama; and corporate headquarters including some of the largest banking corporations. Recently the South has experienced a rapid growth and advancement in its service economy, manufacturing base, high technology industries, and the financial sectors. This rapid economic expansion has increased employment in many sectors of the South's economy and led to very low unemployment rates compared to the rest of the nation.

The states of Alabama, Florida, Louisiana, Mississippi, North Carolina, South Carolina, and Virginia are the coastal states. Being a coastal state contributes both positive and negative factors with respect toward migration and economic change. Greenwood, Hunt, and McDowell (1986) considered a combinational effect of some climate and coastline factors into their simultaneous equations model (Greenwood, Micheal J., Gary L. Hunt and John M. McDowell, 1986). The coastal areas of the South provide an excellent opportunity for interaction with the rest of the world by providing

[4] The reason for the exclusion of Virginia is explained in Section 1.4.2.

harbors, entertainment, fishing fleets, seafood processing, and offshore oil and gas production. Southern coastal areas not only provide services by direct accessibility, but they also create an attraction for international visitors and tourism. These areas provide recreation and openness for millions of families/tourists from diverse urban and rural areas as well as worldwide. On the other hand, such areas are subject to overcrowding and environmental encroachment as well as periodic damage from hurricanes and heavy weather.

1.4 Problem Identifications, Scope and Limitations of the Study

1.4.1 Problem Statement

The study of the relationship between population and socio-economic changes has been a long-standing and challenging object of inquiry for economists, sociologists, geographers and politicians. Previous studies have focused on the interdependence between migration and economic growth or the simultaneous equation model of migration and economic changes; no studies could be found in the current literature that utilizes structural equation modeling. This has primarily been due to the extensive data requirements; "the absence of this type of model has in a sense stunted efforts to study the macroeconomic consequences of migration, as noted by Greenwood, Mueser, Plane, and Schlottmann" (Al-Dakhil, Khalid I., 1997). The main purpose of this study is to investigate the distribution of economic activity and population growth over space. An extensive literature review failed to find any previous studies utilizing GIS modeling approaches to give additional insight and visualization to the result of a structural

equation model. Most of the GIS spatial analyses simply map the data; a few of them show spatial autocorrelation and spatial clustering. This study, however, combines GIS, Spatial Lag, Structural Equation Modeling, and Cluster Analysis in order to provide a fuller/broader understanding of the spatial socioeconomic relationships.

Data for some estimates (such as the average annual rate of change of total population density from 1995 to 2000, in-migration and out-migration rates from 1995 to 2000, the ratio of number of births to number of deaths for 1995, the ratio of percentage of other race population to percentage of white population for 1995, and gravity to the large cities) are slightly skewed and kurtosic; therefore, normality theory data transformation must be applied. The data obtained is at the county level. Some counties are big counties, and some counties are small counties in terms of the total population, which creates a vast variation problem in the dataset. For instance, if there is any change of 50 units, then the effect of this change toward a small county will be huge; but for a big county, it may be negligible. Therefore, the natural logarithm transformation is applied in these estimates in order to apply for normality theory.

1.4.2 Limitations and Scope of the Study

This study has several minor limitations which are listed below. None of them should be considered major impediments.

According to the Bureau of Economic Analysis, the southeast region includes the state of Virginia; this study excludes Virginia in the models. Virginia is excluded because county- and city-level data are mixed. "In Virginia, one or more cities are independent of counties and are treated as statistical equivalents of counties" (U.S.

Census Bureau, 2001). Since much of this dataset is from multiple institutions, some of which do not use the same concept, it is difficult to construct information for equivalent counties.

This study uses internal in- and out-migration from county to county assuming the natural growth rate (births minus deaths) is more likely to have an exogenous behavior (Greenwood, Micheal G, 1981). Internal migration data is cross-sectional data that is collected every five years from the current population survey; therefore it is not an annual time series data. The 2000 out-migration data measures the people in 2000 who resided in a county different than the one where they resided in 1995. Using that data as a basis, this study is, therefore, focused on the timeline from 1995 to 2000.

The data used in estimation for social development indicators/factors is collected for every 10 years. Therefore, exogenous variables for social development characteristics are estimated by using the data from the 1990's.

The study is very broad and covers an extensive geographic area; therefore, nuances particular to specific places may be missed. Only major factors of determinants and consequences will be included in the model.

1.5 Purposes and Hypotheses

1.5.1 Research Question

The overall research question in this study is: *How were county level population growth, localized social structures, and economic growth interrelated and distributed in the southeast region of the United States during the period of 1995-2000?*

There are several steps in answering this question. The first three are concerned with measurements of economic growth, population growth, and social development factors, which are then employed in the structural model. In these first steps, descriptive statistics analysis, correlation analysis, confirmatory factor analysis, statistical cluster analysis, mapping, and spatial autocorrelation analysis, including spatial cluster and spatial hot and cold spot analysis, will be used to demonstrate the degree to which these factors are associated with rural/urban and coastal/non-coastal spatial relationships. These analyses are for the first stage that will be employed to investigate "where" and "what" types of questions.

Step 1. It is to determine the appropriate factor loading for each measurement in the economic growth factor for the southeast region from 1995 to 2000. Using factor analysis, this question addresses how important each of the characteristics is in the factor produced to represent economic growth. The question includes an examination of what reliability and validity analyses suggest about the measurements, and how these measurements differ between urban and rural counties as well as between coastal and non-coastal counties. The elements that represent economic growth factor *(F1)* from 1995 to 2000 are the average annual rate of per capita personal income *(PINCGRO)*, the average annual rate of change of the total number of people employed *(EMPGRO)*, and the average annual rate of change in the number of establishments (by size) *(ESTGRO)*. (See Table 1.1 and Figure 1.4) Each of these elements will be examined through the use of descriptive statistics, cluster analysis, and mapping and spatial analysis. The underlying reason for this part of the analysis is to produce an economic growth

measurement factor that can be used to represent economic growth in the structural model.

Table 1.1 View of Analysis for Step 1

Topic	Data Source	Unit of Analysis	Analysis
Average Annual Rate of Change of Real per Capita Personal Income, from 1995 to 2000 *(PINCGRO)*	Bureau of Economic Analysis	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
Average Annual Rate of Change of Total Number of People Employed, from 1995 to 2000 *(EMPGRO)*	Bureau of Labor Statistics	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
Average Annual Rate of Change of Number of Establishments with Respect to the Size of Employee, from 1995 to 2000 *(ESTGRO)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
Economic Growth Measurement Model (*F1*- Economic Growth Factor or Latent Variable)	Bureaus of Census, Economic Analysis, and Labor Statistics	County	• Correlation Analysis • Hierarchical Cluster Analysis • Spatial Autocorrelation Analysis • Confirmatory Factor Analysis • GIS Raster Modeling

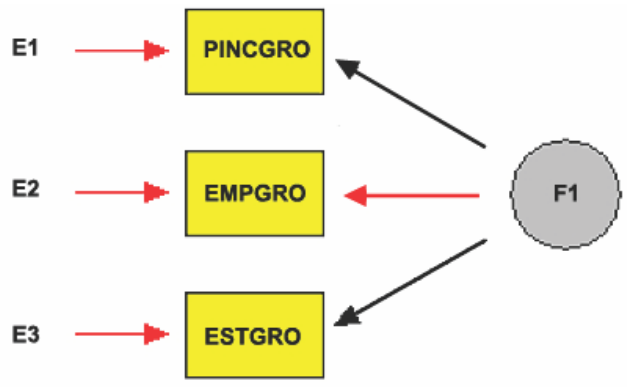


Figure 1.4 The Economic Growth Measurement Model

$$
\begin{aligned}
PINCGRO &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\
EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\
ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3
\end{aligned}
\tag{1-1}
$$

The measurement model for the economic growth depicted in Figure 1.4 and in Equation (1-1) specifies how each individual measurement variable is related to the latent variable (the economic growth factor) and whether each is statistically significant. The measurement model is demonstrated in a GIS raster model.[5] The coastal and non-coastal, as well as rural and urban, differences are determined in the analysis.

Step 2. Determine the appropriate factor loading for each measurement in the population growth factor for the southeast region from 1995 to 2000. Using factor analysis, this question addresses how important each of the characteristics is in the factor produced to represent population growth. The question includes an examination of what reliability and validity analyses suggest about the measurements and how these measurements differ between urban and rural counties as well as coastal and non-coastal counties. The elements (see Table 1.2) included in the 1995 to 2000 population growth factor *(F2)* (see figure 1.5) include the average annual rate of change of population density from 1995 to 2000 *(LNDENGRO)*, the rate of in-migration *(LNIMRR),* and the rate of out-migration *(LNOMRR).* Each of these elements will be examined through the use of descriptive statistics, cluster analysis, mapping, and spatial analysis. The underlying reason for this part of the analysis is to produce a population growth

[5] "The raster data model represents features as a matrix of cells in continuous space. Each layer represents one attribute (although other attributes can be attached to a cell). Most analysis occurs by combining the layers to create new layers with new cell values" (ESRI, 2006). "The idea of a GIS raster data model is to formally construct a method the computer can use so that the graphical entities and the descriptive attributes can be linked, particularly where multiple themes are used"(DeMers, Michael N., 2002).

measurement factor that can be used to represent population growth in the structural model.

Table 1.2 View of Analysis for Step 2

Topic	Data Source	Unit of Analysis	Analysis
Average Annual Rate of Change of Population Density from 1995 to 2000 *(LNDENGRO)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
In-Migration Rate from 1995 to 2000 *(LNIMRR)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
Out-Migration Rate from 1995 to 2000 *(LNOMRR)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Statistics Analysis
The Population Growth Measurement Model from 1995 to 2000 (*F2* – Population Growth Factor or Latent Variable)	Bureau of Census	County	• Correlation Analysis • Hierarchical Cluster Analysis • Spatial Autocorrelation Analysis • Confirmatory Factor Analysis • GIS Raster Modeling

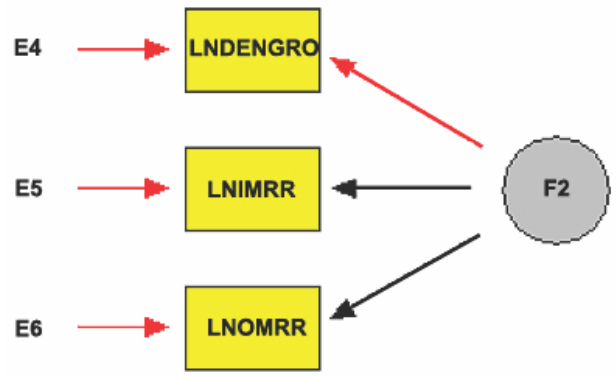


Figure 1.5 The Population Growth Measurement Model

$$
\begin{aligned}
LNDENGRO &= V_4 = \beta_{01} + \beta_{21} \cdot F_2 + E_4 \\
LNOMRR &= V_5 = \beta_{03} + \beta_{23} \cdot F_2 + E_5 \\
LNIMRR &= V_6 = \beta_{02} + \beta_{22} \cdot F_2 + E_6
\end{aligned}
\tag{1-2}
$$

The measurement model for the population growth depicted in Figure 1.5 and in Equation (1-2) specifies how each individual measurement variable is related to the latent variable (the population growth factor) and whether each is significant or not. The measurement model is demonstrated in a GIS raster model. The rural and urban, as well as coastal and non-coastal, differences are determined in the analysis.

Step 3. Determine the appropriate factor loading for each measurement in the socioeconomic development factor for the Southeast region from 1995 to 2000. Using factor analysis, this question addresses how important each of the characteristics is in the factor produced to represent socioeconomic development. The question includes an examination of what reliability and validity analyses suggest about the measurements and how these measurements differ between urban and rural counties, as well as differences between coastal and non-coastal counties. The elements (see Table 1.3) included in the 2000 social development factor *(F3)* (see Figure 1.6) are the economic opportunity index *(ECON_00),* the education dimension index *(EDUC_00),* and the housing dimension index *(HOUS_00*). Each of these elements will be examined through the use of descriptive statistics, cluster analysis, and mapping and spatial analysis. The underlying reason for this part of the analysis is to produce a socioeconomic development measurement factor that can be used to represent social development in the structural model.

Table 1.3 View of Analysis for Step3

Topic	Data Source	Unit of Analysis	Analysis
Economic Opportunity Index for 2000 *(ECON_00)*	Bureau of Census, Bureau of Labor Statistics	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
Education Dimension Index for 2000 *(EDUC_00)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
Housing Dimension Index for 2000 *(HOUS_00)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
The Socioeconomic Development Measurement Model for 2000 (*F3* – Socioeconomic Development Factor or Latent variable)	Bureau of Census, Bureau of Labor Statistics	County	• Correlation Analysis • Hierarchical Cluster Analysis • Spatial Autocorrelation Analysis • Confirmatory Factor Analysis • GIS Raster Modeling

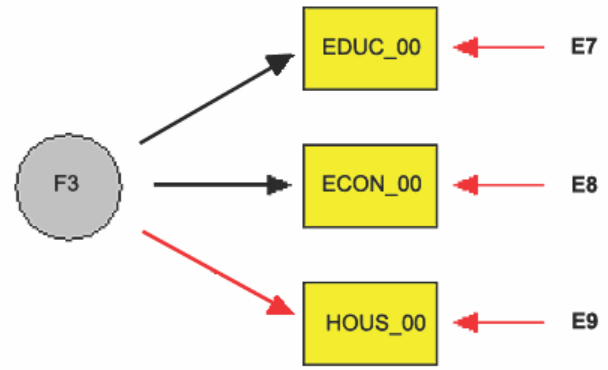


Figure 1.6 The Social Development Measurement Model

$$
\begin{aligned}
HOUS_00 &= V_7 = \gamma_{01} + \gamma_{31} \cdot F_3 + E_7 \\
EDUC_00 &= V_8 = \gamma_{02} + \gamma_{32} \cdot F_3 + E_8 \\
ECON_00 &= V_9 = \gamma_{03} + \gamma_{33} \cdot F_3 + E_9
\end{aligned}
\tag{1-3}
$$

The measurement model for the 2000 social development depicted in Figure 1.6 and in Equation (1-3) specifies how each individual measurement variable is related to the latent variable (the social development factor) and whether each is significant or not. The measurement model is demonstrated in a GIS raster model. The rural and urban, as well as coastal and non-coastal, differences are determined in the analysis.

Step 4. The operating assumption taken from theory is that economic and population growth is important in determining social development and that the three, taken together, are indicative of overall socioeconomic development. Toward that end, the fourth step examines how the relationship between the population growth and economic growth from 1995 to 2000 affects the social development for 2000 for the southeast region. A structural equation model is used (see Table 1.4, Figure 1.7, and Equation (1-4)). This requires determining the effect indicators of the construct and whether the causal direction goes from the latent variables to the indicators. Finally, spatial differences in overall socioeconomic development are determined.

Table 1.4 View of Analysis for Step 4

Topic	Data Source	Unit of Analysis	Analysis
The Structural Equation Model I for the Socioeconomic Development of the Southeast Region for 2000	Bureau of Census, Bureau of Economic Analysis, and Bureau of Labor Statistics	County	• Correlation Analysis • Structural Equation Modeling Analysis or Path Analysis • GIS Raster Modeling

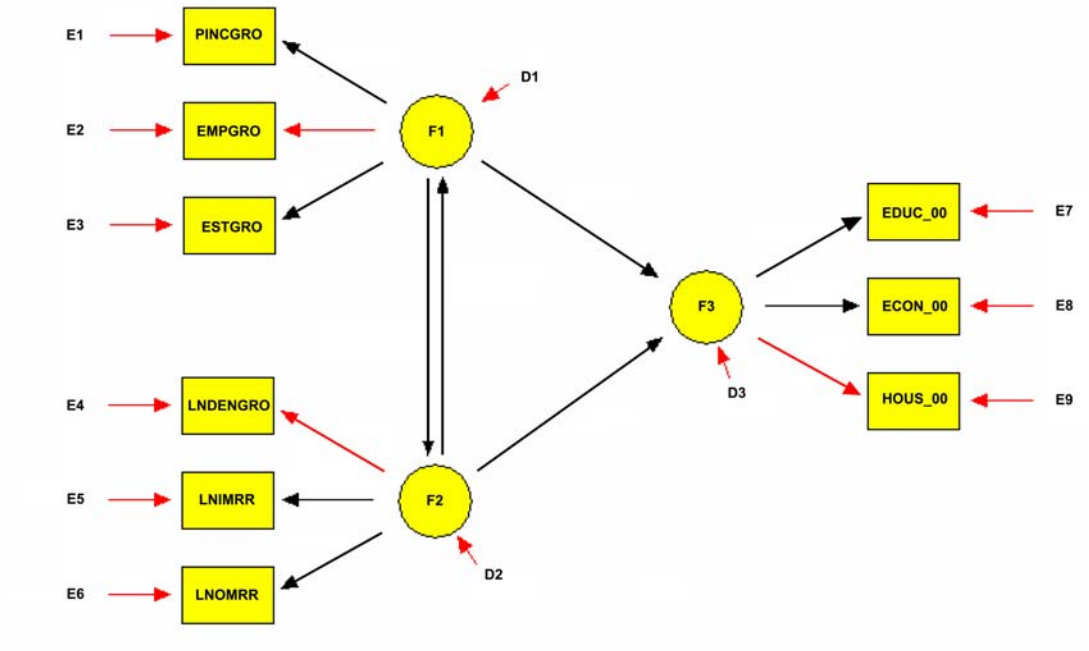


Figure 1.7 The Full Structural Equation Model I for the Socioeconomic Development of the Southeast Region

$$
\begin{aligned}
PINCGRO &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\
EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\
ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3 \\
LNDENGRO &= V_4 = \alpha_{04} + \alpha_{21} \cdot F_2 + E_4 \\
LNIMRR &= V_5 = \alpha_{05} + \alpha_{22} \cdot F_2 + E_5 \\
LNOMRR &= V_6 = \alpha_{06} + \alpha_{23} \cdot F_2 + E_6 \\
EDUC_00 &= V_7 = \alpha_{07} + \alpha_{31} \cdot F_3 + E_7 \\
ECON_00 &= V_8 = \alpha_{08} + \alpha_{32} \cdot F_3 + E_8 \\
HOUS_00 &= V_9 = \alpha_{09} + \alpha_{33} \cdot F_3 + E_9 \\
F_1 &= \alpha_{41} \cdot F_2 + D_1 \\
F_2 &= \alpha_{51} \cdot F_1 + D_2 \\
F_3 &= \alpha_{61} \cdot F_1 + \alpha_{62} \cdot F_2 + D_3
\end{aligned}
\tag{1-4}
$$

In this step, a non-recursive structural equation model of socioeconomic development of the southeast region is constructed and tested. Confirmatory factor

analysis and path analysis are employed; therefore, direct, indirect, and the total effect of each construct is estimated. Cluster analysis, spatial autocorrelation, and hot and cold spot analysis are also employed. The results of the structural equation model are demonstrated in the GIS raster model. The coastal difference and rural and urban difference are shown in this analysis.

Step 5. Finally, a full socioeconomic model (Table 1.5, Figure 1.8, Equation (1-5)) is constructed based upon the basic model constructed in step 4. Here, other socioeconomic development factors are included in the analysis. The relationship between population growth and economic growth and their effects on social development are determined in a structural equation model given certain important exogenous variables. Those exogenous variables include variables represented in Table 1.5:

(i) Demographic characteristics (average rate of the ratio of the number of deaths to the number of births from 1995 to 2000, median age for 1995, and the ratio of the percentage of the other race population to percentage of the white population for 1995);

(ii) Social development levels in 1990 (a human development index which includes education, economic opportunity, and housing indices from 1990);

(iii) Urban transition characteristics (the average gravitation into the large cities, and dummy variables for rural/urban continuum); and

(iv) Environmental characteristics (dummy variables indicating coastal states).

How do the exogenous variables affect the relationship between the population growth and economic growth from 1995 to 2000, as well as the socioeconomic development for 2000 for the southeast region? What are the effect indicators of the construct with the causal direction going from the latent variables to the indicators? How

are these measurements different for urban and rural counties, as well as coastal and non-coastal counties?

Table 1.5 View of Analysis for Step 5

Topic	Data Source	Unit of Analysis	Analysis
Demographic Characteristics *(LNNATINC, MEDAGE, LNRACE)*	Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
Social Development Level for 1990 *(EDUC_90, ECON_90, HOUS_90)*	Bureau of Census, Bureau of Economic Analysis, and Bureau of Labor Statistics	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
Urban Transition *(LNGRAV, RUC)*	ESRI, U.S. Department of Agriculture	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
Coastal Characteristics *(COAST)*	U.S. Bureau of Census	County	• Descriptive Statistics Analysis • Mapping and Spatial Analysis
The Full Structural Equation Model II for the Socioeconomic Development of the Southeast Region for 2000	Bureau of Census, Bureau of Economic Analysis, and Bureau of Labor Statistics	County	• Correlation Analysis • Structural Equation Modeling Analysis or Path Analysis • Spatial Autocorrelation Analysis • GIS Raster Modeling • Spatial Lag Modeling

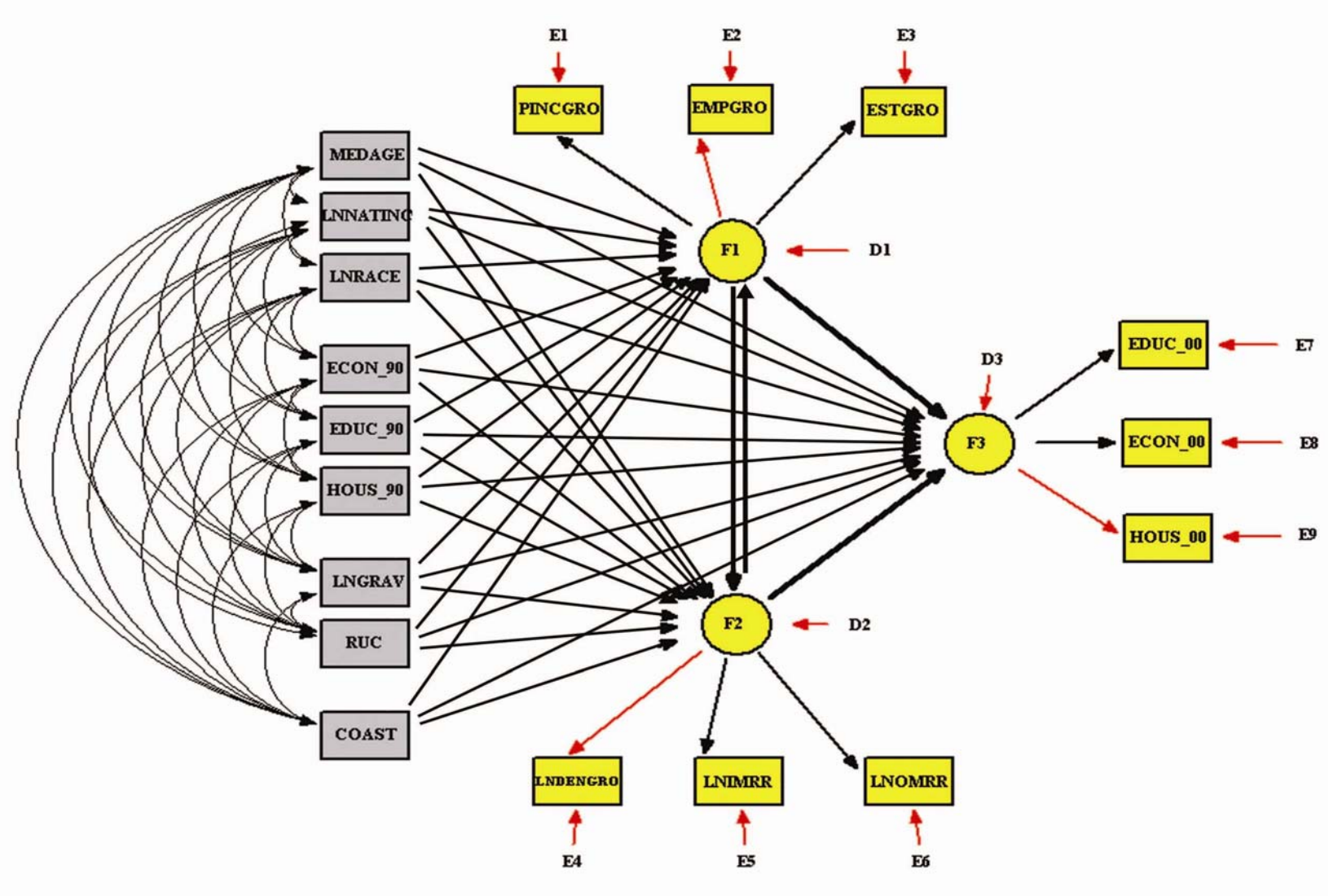


Figure 1.8 The Full Structural Equation Model II for the Socioeconomic Development of the Southeast Region

$$
\begin{aligned}
PINCGRO &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\
EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\
ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3 \\
LNDENGRO &= V_4 = \alpha_{05} + \alpha_{21} \cdot F_2 + E_4 \\
LNIMRR &= V_5 = \alpha_{06} + \alpha_{22} \cdot F_2 + E_5 \\
LNOMRR &= V_6 = \alpha_{07} + \alpha_{23} \cdot F_2 + E_6 \\
EDUC_00 &= V_7 = \alpha_{08} + \alpha_{31} \cdot F_3 + E_7 \\
ECON_00 &= V_8 = \alpha_{02} + \alpha_{32} \cdot F_3 + E_8 \\
HOUS_00 &= V_9 = \alpha_{03} + \alpha_{33} \cdot F_3 + E_9 \\
F_1 &= \alpha_{41} \cdot F_2 + \alpha_{42} \cdot V_{10} + \alpha_{43} \cdot V_{11} + \alpha_{44} \cdot V_{12} + \alpha_{45} \cdot V_{13} \\
&\quad + \alpha_{46} \cdot V_{14} + \alpha_{47} \cdot V_{15} + \alpha_{48} \cdot V_{16} + \alpha_{49} \cdot V_{17} + \alpha_{50} \cdot V_{18} + D_1 \\
F_2 &= \alpha_{51} \cdot F_1 + \alpha_{52} \cdot V_{10} + \alpha_{53} \cdot V_{11} + \alpha_{54} \cdot V_{12} + \alpha_{55} \cdot V_{13} \\
&\quad + \alpha_{56} \cdot V_{14} + \alpha_{57} \cdot V_{15} + \alpha_{58} \cdot V_{16} + \alpha_{59} \cdot V_{17} + \alpha_{510} \cdot V_{18} + D_2 \\
F_3 &= \alpha_{61} \cdot F_1 + \alpha_{62} \cdot F_2 + \alpha_{63} \cdot V_{10} + \alpha_{64} \cdot V_{11} + \alpha_{65} \cdot V_{12} \\
&\quad + \alpha_{66} \cdot V_{13} + \alpha_{67} \cdot V_{14} + \alpha_{68} \cdot V_{15} + \alpha_{69} \cdot V_{16} + \alpha_{610} \cdot V_{17} + \alpha_{611} \cdot V_{18} + D_3
\end{aligned}
\qquad (1-5)
$$

The model is a non-recursive full structural equation model for socioeconomic development of the southeast region. Confirmatory factor analysis and path analysis are also employed; therefore, direct, indirect, and the total effects of each construct are estimated. Cluster analysis and spatial autocorrelation, including spatial cluster and hot and cold spot analysis, are employed. The full structural equation model is then demonstrated in the GIS raster model. The rural, urban, coastal, and non-coastal differences are highlighted in the analysis.

1.5.2 Statement of Hypotheses

Based on the problem identification and research questions, this paper will examine the following four main hypotheses:

Hypothesis 1

H_0: $\alpha_{41} > 0$ (The population growth factor has significant positive effect on the economic growth factor.)

H_1: $\alpha_{41} \leq 0$ (The population growth factor has significant negative effect or no effect on the economic growth.)

Hypothesis 2

H_0: $\alpha_{51} > 0$ (The economic growth factor has significant positive effect on the population growth.)

H_1: $\alpha_{51} \leq 0$ (The economic growth factor has significant negative effect or no effect on the population growth.)

Hypothesis 3

H_0: $\alpha_{61} > 0$ (The economic growth has positive effect on the socioeconomic development for 2000.)

H_1: $\alpha_{61} \leq 0$ (The economic growth factor has significant negative effect or no effect on the socioeconomic development for 2000.)

Hypothesis 4

H_0: $\alpha_{62} < 0$ (The population growth may have significant negative effect on the socioeconomic development for 2000.)

H_1: $\alpha_{62} \geq 0$ (The population growth factor has significant positive effect or no effect on the socioeconomic development for 2000.)

Hypothesis 5

H_0: The exogenous indicators have significant effect on the economic and population growth from 1995 to 2000, and socioeconomic development for 2000.

H_1: The exogenous indicators have no significant effect or no effect on the economic and population growth from 1995 to 2000, and socioeconomic development for 2000.

Table 1.5 and Table 1.6 show null hypotheses for full structural equation model I and II.

Table 1.6 Null Hypotheses for Full Structural Equation Model I

Latent Variables	Effects	Endogenous Variables											
		Economic Growth Indicators			Population Growth Indicators			Social Development Indicators			Factors / Latent Variables		
		PINCGRO	*EMPGRO*	*ESTGRO*	*LNDENGRO*	*LNOMRR*	*LNIMRR*	*HOUS_00*	*EDUC_00*	*ECON_00*	*F1*	*F2*	*F3*
		H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0
F1 Economic Growth Factor	Total	+	+	+	+	-	+	+	+	+	+	+	+
	Direct	+	+	+	0	0	0	0	0	0	0	+	+
	Indirect	+	+	+	+	?	+	+	+	+	+	+	+
F2 Population Growth Factor	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	+	+	+	0	0	0	+	0	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
F3 Social Development Factor	Total	NA	NA	NA	NA	NA	NA	+	+	+	NA	NA	NA
	Direct	NA	NA	NA	NA	NA	NA	+	+	+	NA	NA	NA
	Indirect	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA	NA

Note: If H_0: positive effect, then H_1: negative or no effect.
If H_0: negative effect, then H_1: positive or no effect.
If H_0: zero effect, then H_1: non zero effect.

Table 1.7 Null Hypotheses for Full Structural Equation Model II

Exogenous Variables	Effects	Endogenous Variables											
		Economic Growth Measurements			Population Growth Measurements			Social Development Measurements			Factors / Latent Variables		
		PINCGRO	*EMPGRO*	*ESTGRO*	*LNDENGRO*	*LNOMRR*	*LNIMRR*	*HOUS_00*	*EDUC_00*	*ECON_00*	*F1*	*F2*	*F3*
		H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0	H_0
NATINC	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	0	0	0	0	0	0	+	+	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
MEDAGE	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	0	0	0	0	0	0	+	+	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
LNRACE	Total	-	-	-	-	-	-	-	-	-	-	-	-
	Direct	0	0	0	0	0	0	0	0	0	-	+	-
	Indirect	-	-	-	-	-	-	-	-	-	-	-	-
ECON_90	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	0	0	0	0	0	0	+	+	+
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
EDUC_90	Total	+	+	+	+	+	+	-	-	-	+	+	-
	Direct	0	0	0	0	0	0	0	0	0	+	+	-
	Indirect	+	+	+	+	+	+	-	-	-	+	+	+
HOUS_90	Total	-	-	-	-	-	-	+	+	+	-	-	+
	Direct	0	0	0	0	0	0	0	0	0	+	-	+
	Indirect	-	-	-	-	-	-	+	+	+	-	-	-
LNGRAV	Total	+	+	+	+	+	+	-	-	-	+	+	-
	Direct	0	0	0	0	0	0	0	0	0	-	+	-
	Indirect	+	+	+	+	+	+	-	-	-	+	+	+

[1] Null hypotheses for latent variables effects on endogenous variables are same as Full Structural Model I in Table 1.5. Therefore only null hypotheses for exogenous variables on endogenous variables are included.

1.6 Summary

The main purpose of this study is to investigate *"How are county level population growth, localized social structures, and economic growth interrelated and distributed in the southeast region of the United States during the period of 1995-2000?"*

Factor analysis is used to convert individual variables into factors that can represent the three interrelated constructs of economic growth, population growth, and social development. Those factors are initially used to build a non-recursive structural model and to verify the direction of causation. Finally, exogenous variables representing economic, demographic, social, urban transition, and environmental are included in a full non-recursive structural equation model which demonstrates the importance of each factor, the direct and indirect effects of individual variables, and the spatial differentiation in socioeconomic development for all of the counties in the southeast region. These relationships are demonstrated using GIS mapping, and further analysis is used to examine the spatial differences in development. Data are collected from the U.S. Census Bureau, the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, U.S. Department of Agriculture, and GeoDatabase from ESRI.

Five main hypotheses are postulated:

1) The population growth factor has a significant positive effect on the economic growth factor.
2) The economic growth factor has significant positive effect on population growth.
3) Economic growth has a positive effect on the social development for 2000.
4) Population growth is significant and negative on the social development for 2000.

5) The exogenous indicators have significant effect on the economic and population growth from 1995 to 2000, and social development for 2000.

CHAPTER II

THEORETICAL PERSPECTIVES AND LITERATURE REVIEW

Economic systems are dynamic entities and are persistently becoming more and more complex. The nature and consequences of changes in these systems are vital because such changes have an effect on the well being of individuals and households, the economical, social and political structure of communities, regions, and eventually nations, as well as the world.

Therefore, we have to ask ourselves, what constitutes a developing or growing locality? Where? What? Why? The most essential, if not fundamental, topic for an urban economist or a regional scientist to study is geared around the study of people – the producers, workers, the exchangers, and the customers of every item and service of economic value. Urban economists and regional scientists seek to identify the factors leading the distribution of economic activity over space (Hoover, Edgar M. and Frank Giarratani, 1999). This section examines the theories in the field of economic geography and demography that deal with urban and regional economic development. Special emphasis is given to theoretical contributions that directly affect the issue of causation and systematic spatial patterns in socioeconomic development. Especially important are the relationships between economic, population, social development, and other socioeconomic elements of development. The discussion starts with answering the

question of how to determine the social development; it is followed by theoretical perspectives of economic growth and population growth and their interrelated role in socioeconomic development. Finally the literature concerning structural equation modeling, GIS modeling, and spatial econometric analysis is explored.

2.1 Measuring Socioeconomic Development

What do researchers do to understand socioeconomic development? The socioeconomic development conceptual framework is an extensive concept that generally includes anything that improves the quality of human life. Regional economists generally attribute such improvements to increasing per capita income, reducing poverty and unemployment, enhancing individual economic opportunities, having better education, improving health and nutrition, having better housing and housing services, conservation of natural resources, a cleaner environment, and a richer cultural of life. Socioeconomic development can be explained by the development of economic wealth of an area for the well-being of the individuals. In this research, socioeconomic development is defined as a dynamic process in which the interdependent relationship between population and economic growth determines social development. Therefore, the level of socioeconomic development is classified into three dimensions: social development, economic growth, and population growth.

2.1.1 Measuring Social Development

The level of social development is classified into the level of economic opportunity, education, and quality of life/housing dimensions. These dimension indicators are used because they are generally consistent with social development or the country's well-being concept and the United Nation's human development index concept.

2.1.1.1 Social Development Is Economic Opportunity Dimension

In attempting to construct a definition of social development, a few main ideas from well-known researchers were utilized in the construction of the definition of social development developed for this project:

Clark, Rosenstein-Rodan, Hoselitz, Nurske, Viner, and Myint developed early economic development theories. Among them, Nurske stated that development is output growth, and the center component of the economic development problem is capital formation (Nurkse, Ragnar, 1953). Nurske also believes there are two basic types of underdeveloped countries: densely populated and sparsely populated. For densely populated areas, Nurske believes that turning rural manpower, concealed as unemployment, to productive use can increase capital accumulation. As for sparsely populated areas, Nurkse states that there is no margin for disguised unemployment. Therefore, an increase in productivity in agricultural use would furnish the margin for capital accumulation (Nurkse, Ragnar, 1953).

Sir W. A. Lewis's early work introduced the role of saving in the economic development. Lewis (1954) acknowledged that the high saving ratio out of profits aids to

accelerate economic development and the absorption of the labor surplus from traditional sector through rapidly expanding primarily industrial sectors (Barker, T.E. , 1982). The recently formed Keynesians and Lewis endeavored to bring about the issue of income distribution as a determinant of savings and growth. In addition, within the analytical Keynesian framework, Harrod and Domar (Domar, Evsey 1957, Harrod, Roy F. , 1939) stressed that the process of economic development depends on the level of saving and increases in the saving ratio (from 5% to 10-12%) and the productivity of investment. Full employment, market clearance, and perfect competition were assumed (Romer, 1998**).

Dudley Seers argued that development was a social phenomenon that entails more than increasing per capita output. Seers opinion was that development also meant eradicating poverty, unemployment, and inequality (Othick, John, 1983). Robert Solow contributed the idea that an economic system would correct itself without any influences to automatically maintain full employment. Solow believed that there was a balanced investment which kept the growth of the capital stock equal to the growth of labor force. He believed this to be a rate of investment. Solow also defined what he called the steady-state point. He said that if actual investments exceed balanced investments, the amount of capital per worker would grow until it reaches a level consistent with full employment.

Glasmeier wrote that economic distress is not new and that public policy is designed to contend with recent state and regional differences in economic development (Glasmeier, Amy, 2000). The bulk of economic development policy experiences are relevant to two geographic scales; these are the region and the city (Glasmeier, Amy,

2000). For both city and regional scales, the attention is directed at focusing on policy interventions and developing discourses on the resolution of uneven development (Glasmeier, Amy, 2000).

From these development theories, the conclusion can generally be drawn that economic opportunity dimension indicators of level of social development should be associated with positive socioeconomic outcomes such as higher income levels, lower levels of income inequality, poverty, and unemployment.

2.1.1.2 The Education Dimension of Social Development

Most people commonly believe capital means physical capital, money, saving, bank account, stock, land, etc. But these tangible forms of capital are not the only substantial forms. Theodore. W. Schultz (1945, 1949, 1963, 1964, 1971, and 1972) accentuated the need for human capital, which he believed would lead to an emphasis on education, vocational skills, research and its application as a requirement of economic development. The concept of human capital allows a means of identifying and analyzing the brain-drain problem. Sir Arthur W. Lewis (1954, 1955, 1961, 1969, and 1978) focused on the efficiency and development of agriculture as a crucial factor for growth of the developing countries. Lewis focused on the dual nature of economy: the existence of two different systems in one region. One system supports local needs, which is the agricultural sector. Low productivity of agriculture is a reason for the poverty and a restriction of the growth. The other system is geared to the global export needs, which is a dynamic industrial sector. Schultz's and Lewis's analysis of development problems

have some common features, such as a holistic concept of social development and an emphasis on improving human capital.

Having the skills to gather knowledgeable understanding and reaping the resulting economic benefits is vital to socioeconomic development, technological change, and industrial evolution (Becker, Gary S., Kevin M. Murphy and Robert Tamura, 1990, Feldman, Maryann, 2000, Krugman, Paul, 1991a, b, Lucas, Robert E. , 1988, 1993, Romer, Paul M., 1986, 1990). Education and training are the most important investment in the human capital.

During the 19th and 20th century, the continuing growth in per capita income over time across countries and regions was highly correlated with technological and scientific knowledge and education, school enrollment, skills, and experience (David, Paul A., 1975, Drummond, Ian M., 1976). Therefore, this research also concerns itself with one of the main important measurements of the social development - human capital dimension - which can be measured by educational attainments and school enrollment.

2.1.1.3 The Quality of Life Dimension of Social Development – Area Neighborhood

There are palaces/mansions in the world, and there also are shacks or slums. The living environments and atmospheres are dissimilar from place to place, and the living standards of people are also incredibly diverse. Lee and Murie (1997) argue that the quality of housing is not the result of poverty, but a factor that contributes to the problem of social integration and development. They also argue that low quality housing and homelessness contribute to what they refer to as “social exclusion.” Social exclusion

refers to the characteristic of being generally deprived of any stake or influence in their social surroundings (Lee, Peter and Alan Murie, 1997). The pattern of deprivation coincides with patterns of housing tenure. Housing tenure and deprivation are strongly related to unemployment, poverty, and income or economic deprivation (Dean, John P. , 1949, Hunt, Bradford D., 1997).

Bradford (1996) investigates the story of a “lost opportunity” in American housing policy. She believes the opportunity existed to avoid the "two-tiered" system that divides state support for housing into nearly invisible subsidies for the suburban middle and upper classes (FHA insurance programs, mortgage interest and property tax deductions) (Hunt, Bradford D., 1997). She also believes that losing this opportunity resulted in the creation of “stingy warehouses for the poor,” called public housing (Hunt, Bradford D., 1997).

Many labor economists believe that there will be labor shortages for some industries unless there is housing near or around the vicinity, since people need to live near the community or neighborhood where they work; this, in turn, provides labor supply for the industrial sector (Henley, Andrew, Richard Disney and Alan Carruth, 1994, Kohlhase, Janet E. , 1986). When there is a dearth of affordable and adequate quality housing, it retards in-migration, which leads to losses in local industrial and educational sectors and the resulting loss of a tax base for the area. The lack of housing is a limiting factor to economic growth in regard to the quality of life of current employees (Henley, Andrew, Richard Disney and Alan Carruth, 1994).

The level of social development is also constructed from the housing dimension of social development; it normally includes total number of housing units, number of owner-occupied housing units, and median value of owned occupied housing units (Estrada, Joselito K., 2005).

2.1.2 Socioeconomic Development and Economic Geography

The locality of inhabitants and their activities reason the nature and quality/caliber of existence (Glaeser, Edward L., 2000). Urban economists and regional scientists bestow this central dogma about the significance of space (Glaeser, Edward L., 2000). About thirty-five years previous to Glaeser's report, the study of economic geography was isolated in the field of economics; perhaps this was due to the domination of the analytics of location rather than by modern theorizing (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). It was a settled area of research in geography; however, many of the individuals were reluctant to acknowledge the spatial implications of the forces of economic change gathering momentum (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Allen J. Scott wrote that economic geography is comprised of a set of fortuitous intellectual practices geared at achieving significant understandings of our world; however, these understandings are specific (Scott, Allen J. , 2000). "Economic geography as elaborated in this volume is a field of research at the heart of the emerging global economy" (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). In the past, people used to believe that the globe was a structure having an order and spacing of settlements; however, due to globalization difficulties,

documentation is considered essential, and comprehensive explanations are obligatory to establish the spatial scale of economic activity, as well as the spatial allocation of economic activity (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Historically, the economic geography field evolved about the settlement structure of national economies (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Economic geography constitutes a reflection of a great interest for the optimal and proficient spatial allocation of economic activity, whether as a theoretical matter or as a set of empirical facts (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). The discarding of the economically diverse background had led to the focus on mainstream paradigm rooted in mathematical models of competitive and quasi-competitive markets; economists' concentration of interest in economic geography has been gradually more conditional on being adamant that it conforms to this mold (Sheppard, Eric, 2000).

Economists under the influence of Paul Krugman, invigorated the old issues of economic geography through the development of new mathematical theories that can model the economics of spatial agglomeration (Sheppard, Eric, 2000). Most of the work executed in economic geography on spatial agglomeration has essentially focused on the idea of Marshallian industrial districts: "*agglomerations* of closely interrelated small firms benefit from geographic proximity to one another" (Sheppard, Eric, 2000). Agglomeration transpires to exploit clusters of workers/consumers not to be close to one another as in Marshall's theory (Sheppard, Eric, 2000). The fundamental meaning behind agglomeration is the act or process of assembling into a mass, or clustering

(Lexico Publishing Group, LLC, 2006). This is the fundamental concept being used to investigate urban and regional growth and population growth in economics.

Lösch (1954) classified agglomeration economies into either localization economies or urbanization economies (Feldman, Maryann, 2000). Localization economies are characterized as internal to industrial sectors within a geographic region but external to firms (Feldman, Maryann, 2000). In contrast, urbanization economies are scale effects with respect to city size or density (Feldman, Maryann, 2000).

The economic landscape is characterized by difference, differentiation, and heterogeneity (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). "They are part and parcel of the intellectual agenda motivating the field of economic geography" (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Difference, differentiation, and heterogeneity characteristics of socioeconomic landscape occur because the three exist in economic and population growth and structure.

"Difference" pertains to distinguishing geographic patterns of economic attainment. Introduced in the terms of economic research, difference can be measured by indicators such as employment, unemployment, and income. Clark, Feldman, and Gertler (2000) believe differences between urban and regional types of indicators have long been a motive force behind research. While "difference" refers to differences in the level of indicators at given times, "differentiation" suggests that differences between urban and regional indicators are the product of ongoing economic processes that sustain long-term spatial variation and may, therefore, be cumulative in their effects (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Difference and differentiation

characterize large, spatially integrated and extensive economies. Some individuals may postulate that these two should be explained, while others believe that these two are basic to an intellectual understanding of economic geography. Some theorists believe that these two are the foundation for new economic growth and comparative advantage theories (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000).

The concept of heterogeneity simply recognizes that both urban and regional economies are inevitably heterogeneous economies, characterized by information asymmetries, overlapping, and disjointed systems of meaning (Clark, Gordon L., Maryann P. Feldman and Meric S. Gertler, 2000). Together, the concepts of difference, differentiation, and heterogeneity are fundamental to many of the cultural building blocks of economic geography.

GIS tools give additional insight and allow the visualization of information and the results of the models over space. This helps create an understanding of where spatial agglomeration, difference, differentiation, and heterogeneity characteristics of socioeconomic landscape are located. GIS can be used for spatial analysis, mapping, and spatial statistical and econometric analysis and more, depending on the users demand.

2.2 Measuring Economic Growth

Economic growth is an increase in the total value of all goods and services created by an economy. A general way to measure economic growth is to examine the percentage rate of increase in real per capita gross domestic product (GDP). Prior economic growth models for the pre-industrial timeframe employed land-intensive technology – the

Malthus Technology – in which land is a fixed factor and labor has decreasing returns (Hansen, Gary D. and Edward C. Prescott, 2002). In today's era, economic modeling is based on employing a constant-returns-to-scale technology with labor and capital as inputs-the Solow technology (Hansen, Gary D. and Edward C. Prescott, 2002).

Because there is no fixed factor in the Solow production function, population growth has a smaller role in determining the growth rate of per capita income and improvements in the living standard begin (Hansen, Gary D. and Edward C. Prescott, 2002). Such models are based on exogenous technological change. Examples include those given by Robert M. Solow (1957) and recent models with endogenous growth, such as those of Paul M. Romer (1986) and Lucas (1988) (Hansen, Gary D. and Edward C. Prescott, 2002).

This study follows those based on exogenous technological change and uses measures of economic growth that take account of average annual rate of change of per capita personal income, average annual rate of change of total number of people employed, and average annual rate of change of number of establishments with respect to size of employees.

2.2.1 New Economic Growth Theory

Modern economics of urban and regional growth unites traditional urban economics with new theories of economic growth (Glaeser, Edward L., 2000). Pioneering work performed in the area of urban and regional growth provides basic methodological insights. It also provides a very important set of facts about classic urban

issues, such as the interdependency between cities and metropolitan areas (Kain and Neidersorn 1963), the role of transport cost (Hoover 1937), and input price differences (Carlton 1983) (Glaeser, Edward L., 2000). "The urban benefit in eradicating transport costs for goods was utilized by the classic manufacturing cities of the nineteenth century and is formalized in Krugman work (1991), but the once benefit has now decayed when ultimately transport costs declined and manufactures departed from city areas" (Glaeser, Edward L., 2000). "Models of labor market pooling or the division of labor emphasize the role of cities in facilitating the movement of people (Glaeser, Edward L., 2000). However, general concepts tell us that firms locate near other firms that usually have the same/identical type of workers for an interest of the beneficial factor" (Glaeser, Edward L., 2000).

Advancement in economic growth theory in the 1980s emphasized the importance of technology, intellectual spillovers, and human capital externalities (Glaeser, Edward L., 2000, Lexico Publishing Group, LLC, 2006, Lucas, Robert E. , 1988, Romer, Paul M., 1986, 1990). Romer (1990) argues that within traditional models, increases in population suggest increased growth rates, but having a large population is not sufficient to generate economic growth. It is the supply of human capital embedded within that population that is an important determinant of economic growth (Romer, Paul M., 1990).

The technical problem in economic theory or reconciling increasing returns with competitive markets was solved by the concept of knowledge spillovers. According to the new economic growth theory, cities are centers of idea conception and diffusion. Traditional urban models cannot explain cities without incorporating a new body of

theory that emphasizes the flow of ideas. Cities are informational units; therefore, this is the first force of economic growth. Their existence improves the volume and speed of knowledge and information exchange. This gives them an advantage in learning and innovation. This is the second force of economic growth. This explanation has created much interest and a renewal in the evaluation and reassessment of urban economic theory and the role of agglomeration economies (Glaeser, Edward L., 2000).

According to the new economic growth theory, agglomeration is the "third force" in urban and regional growth. This third force predicts that workers and firms will crowd together in dense areas to learn ideas from one another. This force also predicts that areas that are better at producing new ideas will grow more quickly. Cities that produce more ideas will grow because innovators may be temporarily, geographically fixed. The creation of technological knowledge and change is favored within well-defined regions where innovation has become an irreversible part of the culture and induces further innovation (Antonelli, Cristiano, 2000). For that reason, a local evolving and recursive systemic (or hysteretic) process is suggested as a theoretical basis for understanding change in cities. This may help explain some of the differences in economic development, not only between urban and rural areas, but also between different urban areas.

Spatial agglomeration in production is an important factor in addressing economic development. Conceptually, workers are utility maximizers, who are attracted to places with agglomeration economies because of the higher wages that are offered in those places. Such wages are the result of a higher level of labor productivity which is

assumed to come with a dense concentration of economic activity (Hanson, Gordon H., 2000).

Following the connection between agglomeration economies and economic growth, this study assumes that economic growth depends on population growth demographic characteristics of the population, socioeconomic level of 1990 (indices of economic opportunity, education dimension, and housing dimension), and gravity (distance to large cities in the region). Cluster analysis, spatial cluster analysis, and GIS mapping should help to demonstrate differences that are likely to come from agglomeration economies and the resulting clusters of economic activity within local areas.

2.2.2 Classical Theories for Location in Space

New economic growth theory suggests that location is perhaps the most important engine of regional economic growth. Businesses care about location decisions because it costs something, and a new location can drastically affect the overall returns for the business. Who makes the locations decisions, when do they make them, and why do they make the ones they do? These are the questions Hoover points to as fundamental to location theory (Hoover, 1999). He defines the location decision unit as the entity that makes the location decision for the location unit. The location unit is the entity which is at risk being moved. Firms and households/individuals can be thought of as optimizers: households/individuals make decisions to maximize their own utility; firms make

decisions to maximize profits or minimize their costs. This applies to location choices as well. A location choice leads to the discussion on location space theory.

Location theory includes a broad assortment of work by geographers, economists, regional scientists, business theorists, and others in an approach that emphasizes interrelationships instead of individual contributions. A few studies have attempted to organize location in space by introducing theories and concepts regarding the location and spatial arrangement of economic activities in a logical and coherent framework (Lloyd, Peter E. and Peter Dicken, 1972). From the urban and regional perspective, an economic system has a spatial dimension. This is important in explaining local economic growth. Location in space in urban and economic systems has been investigated by authors including Henderson, Fujita, Puu, and Krugman (Henderson, 1988, Fujita, 1989, Puu, 1993, Krugman 1991, 1996a).**

The classical location theory in space divided into four categories: (1) Land use – von Thünen and Alonso; (2) Industrial location (process orientation) – Weber, Smith, Isard, Moses; (3) Central places/market areas – Christaller and Lösch; and (4) Spatial Competition – Hotelling. This brief section provides a note on classical location theories in space, which are mainstream paradigms but fundamental to the paradigm known as "new economic growth theory" or "new economic geography."

2.2.2.1 Land Use Location Theory

Although land can be used for almost anything, the first question would be how to use the land in such a manner that it would be beneficial and efficient to the owner. The

first effort to develop a scientific theory explaining how to use land or the location of economic activity is generally credited to the 19th Century Economist, Johann Heinrich von Thünen (1738-1850). He wanted to figure out the best profitable land use for his estate. He gathered information which was later published in Der Isolierte Staat, translated as "The Isolated State (1826)." He developed the first serious regard toward spatial economics trying to link his theory with the theory of rent. In the 1960's and 1970's, the development of land use theory came about primarily due to the work of William Alonso, Edwin Mills, D. M. de Farranti, Richard Muth, Solow and Vickrey. (See for example: Alonso, 1964, Mills and de Ferranti, 1972, Muth, 1969, Solow and Vickrey) (Kraus, Marvin, 2006). The early models were primarily focused on a monocentric city theoretical model. Since that period, cities have become gradually more polycentric, and the monocentric city model, with its conjecture of a single concentration of employment, has been criticized with the argument that the cities it explains are from a different time interval (Kraus, Marvin, 2006).

Von Thünen (1826) explains how to use agricultural land, which describes land use practices radiating out from a central market location, i.e., the types of agriculture that will prosper around an urban market using "isolated state-controlled system." Since landowners act to maximize their economic well-being, they will make sure that the cheapest cost is possible and will establish the priorities of the businesses. The general approach of von Thünen illustrates the use of distance-based gradient analysis (e.g., the change in land rent with increasing distance from the city center). He developed six concentric zones of agriculture around the market city. If there are several alternative

land uses and locations, and one use may have more value. But if such a product is heavier, more perishable, or more difficult to transport then, ceteris paribus, others will be located closer to the market. The role of demand is just as important as transportation costs, however. The most demanding use will generally be located closest to the market. As the land distance increases from the city (the central market location), the combination of demand and transportation costs will at some distance shift the land use another products. The result is a band of concentric circles of similar land use.

Although the basic forces of von Thünen's theory are still operative, it is also difficult to find examples for the modern world. Part of the reason is that the modern infrastructure system is more complex than the one envisioned by von Thünen. There are several newer land use theories such as the urban land use patterns of Alonso (1964), urban sprawl from Sinclair (1967), and other spatial studies where transportation costs have an influence over decisions on land use and which are extensions of the von Thünen model developed for today's multidimensional and dynamic socioeconomic system. The von Thünen theory was a pioneering step in developing a theory of location for certain economic activities. In order to extend the model to modern residential, commercial, and industrial land use, the von Thünen model required substantial modification (Watkins, Thayer, 2006).

William Alonso's Bid Rent Function Theory (1960, 1964) is an application of the von Thünen model to urban land use as well as the first and most extensively recognized efforts to explain residential location behavior. Whereas von Thünen's theory explained how agricultural land use would be organized around a market center (town), Alonso's

theory accounts for how urban land uses are organized around the Peak Land Value Intersection (PLVI).

Alonso revised the Von Thünen model by the substitution of commuters for farmers and a central business district for the isolated state. The model employs the factors of land use, rent, intensity of land use, and population and employment (Watkins, Thayer, 2006). These factors are functions of distance to the Central Business District of the city as help to determine an economic equilibrium for the market for space (Watkins, Thayer, 2006). Alonso employed the idea of "bid rent" to isolate factors that contribute to the household's willingness to pay for access to the central business district (CBD) of an urban area; he acknowledged that households make choices among alternative locations in order to maximize the utility or satisfaction that they anticipate realizing from a location choice (Hoover, Edgar M. and Frank Giarratani, 1999).** If the household sustains a certain level of utility, the bid rent of a household is defined as the maximum rent that can be paid for a unit of land a quantity of distance from the city center (Unit being perhaps per acre or per square foot) (Hoover, Edgar M. and Frank Giarratani, 1999).

The three primary types of models in urban land use are the concentric zone model, the sector model, and the multiple nuclei model. The "concentric zone model" illustrates the use of urban land as a set of common center point rings with each devoted to a dissimilar land use. In the 1920's, Earnest Burgess built on the studies of Von Thünen and Alonso. Homer Hoyt recalibrated the concentric ring model and created modifications to bestow an explanation for the impact of transportation systems on

accessibility and developed “the sector model.” Chauncy Harris and Edward Ullman understood that many cities were not equivalent with the traditional concentric zone or the sector model. This in turn led them to develop “the multiple nuclei model” around 1945 (Campbell, Harrison S. , 1998).

Harris and Ullman perceived that cities of larger size were developing extensive suburban areas and some suburbs. When these areas reached their cogent magnitude, they were considered to be functioning like smaller business districts. These smaller business districts operated like protectorate junctions, or nuclei, of activity around which land use patterns formed (Campbell, Harrison S. , 1998). Although the central business district (CBD) was perceived as the major center of commerce, Harris and Ullman suggested specialized cells of activity would develop according to explicit requirements of certain activities, different rent-paying abilities, and the tendency for some types of economic activity to cluster together (Campbell, Harrison S., 2006, Campbell, Harrison S. , 1998). The modeling core was the CBD with light manufacturing and wholesaling positioned along transport routes (Campbell, Harrison S. , 1998).

2.2.2.2 Industrial Location Theory

There are times when a decision maker is not worried about choosing the best activity or land use for a particular locality. Once the decision maker has picked the economic activity, the question turns to location. The optimal industrial location is the location where a firm either maximizes its profits or minimizes its costs. For early industrialization, a firm’s location decision was primarily based on the location of raw

materials because locating near raw materials reduced transportation costs and helped to minimize costs of production. Therefore, industries developed in locations at the source of raw materials. Since that time, many other factors have become important to location. The most important factors for the industrial location are the quantity of potential workers and lower range of wage and salary. Therefore, substantial competitive industries may build their plants at vicinities with high population and/or with lower wage salary in order to decrease their labor cost as well as minimizing the cost of employing labor that subsist extended distances. If the industry is substantial, job possibilities may draw a surplus of skilled workers, which may serve as an inducement for other firms from other industries to locate in the same place, thus taking advantage of location economies. Industries are also concerned with the energetic appeal of the working environment and atmosphere. An environment which is sanitary, pleasant, and attractive will allow employees to increase their utility without increasing their wages. Employees, probabilistically speaking, are more likely to stay with the industry, which in the long run, reduces industrial cost (the mathematical dual of increasing profits), increases productivity, and therefore pays higher wages. All of this argues for firms clustering where there are possible mutual agglomeration economies and for workers to cluster in the same places in order to maximize there utility.

Alfred Weber's Least Cost Theory (1909) is the first comprehensive and general theory of industrial location in which an industry located where it could minimize its costs and, therefore. maximize its profits. His model took into account several spatial factors for finding the optimal location and minimal cost for manufacturing plants.

According to Weber's least cost theory, the optimal location of a manufacturing plant in terms of minimizing costs of production would be located in response to three forces: *transportation costs, labor costs, and agglomeration* (Fearon, David, 2006).

Weber reasoned that the point of optimal transportation is based on the costs of transporting from the raw material site to the production site to the consumer. The weighted distance is mathematical vector based on the "material index" – the ratio of weight to intermediate products (raw materials) to finished product. He brought up two special cases, which are: the weight losing case and the weight gaining case. Weber established that the firm minimizes the weight of its products in order to minimize its transportation costs (Snyder, Dan, 2006). If firms produce heavier goods than raw materials used in their production, they would locate near their market. If firms produce light products, they settle near to the raw material source.

Profits are reduced due to higher labor costs; consequently, factories might do better farther from raw materials and markets if inexpensive labor is available at the factory site (Snyder, Dan, 2006). Labor distortion may be considered a primary determinant in production since unskilled labor will have lower salaries due to the lack of educational requirements (and consequent lower levels of productivity). On the other hand, if a company were to require the use of skilled labor with higher education, then this more productive labor would be scarce and cost more.

The third force is agglomeration, which is defined as a phenomenon of spatial clustering. When a significant quantity of enterprises cluster (agglomerate) in the identical environment, they can offer support to each other through the use of shared

talents, services, and facilities (Snyder, Dan, 2006). The clustering and linkages allow individual firms to enjoy both internal and external economies. Auxiliary industries, specialized machines or services, used only occasionally by larger firms tend to locate in agglomeration areas. This would lower costs, since areas characterized by agglomeration are more likely to have significant markets for the output of firms producing in such places.

Deglomeration occurs when companies and services leave because of the diseconomies of industries' excessive concentration. The area has become over-concentrated because, initially, firms can achieve agglomeration economies because of the scale of industrial activities occurring at such places. However, after reaching the global optimal magnitude, local facilities may be low on capacity and begin to experience diseconomies. Then the force of agglomeration is replaced by other forces which promote deglomeration.

Opponents of Weber's locational triangle concept argue that the transportation rate is not directly proportional to distance or to product weight (Alexander, John W. and Lay J. Gibson, 1979). Even though Weber did not consider factor substitution or long-haul economies, his theory does have strength in explaining some causes for current movements such as out-sourcing or establishment movements or migration. The ultimate goal of the industries is to make profit. In order to make a profit, industrial activity will seek the lowest possible production costs. Lower cost production allows lower prices on finished goods which would lead to a greater quantity of sales and more profit.

Walter Isard's Space Economy Theory (1956) is based on Weber's theoretical model and enhanced by introducing it in the context of factor substitution. Weber's dilemma of transport-orientation, market and supply areas, and the problem of agricultural location, as demonstrated by Isard, were all dependent fundamentally on a state of equality between ratios of transportation rates and marginal rates of substitution of transportation inputs (Pfouts, Ralph W., 1957). The locational equilibria thus depends on a condition analgous to the equilibrium condition of a consumer's indifference map (Pfouts, Ralph W., 1957). There may be substitution between transportation costs and production costs in general or between any two types or groups of production costs or revenues, or between production costs and production revenue, etc. (Isard, Walter, 1969). In general, substitution may be made in either outputs or inputs within the constraints set by the profit maximizing or cost minimizing production function until the optimal point is reached. Such possibilities for substitutions means that for each location or pattern of locations that may be considered there are different factor proportions, output mixes, and scales which must also be considered (Isard, Walter, 1969). Therefore, optimization principles rule the paths of substitution, but the location decision becomes far more complex than in the simple Weberian model.

Smith's Spatial Margin Theory is an alternative approach to that of Weber which was put forth by David Smith in 1971. He also extended his industrial location theory in 1981. He suggested that as in the absence of absolute profit maximization, profits could be made anywhere where total revenue exceeds total costs, so there would be a wide area where production was still profitable. Smith introduced the concept of space-cost curves

within the Weberian framework. By taking a cross-section of those space-cost curves, he was able to identify margins of profitability. He acknowledged the misconceptions of Weber by arguing that firms rarely locate at the ideal site but usually somewhere between the two profit margins. He argued that firms do not have perfect knowledge about production or market demands, and they may be easily encouraged to locate in areas of high employment that are not particularly close to either resources or markets. Smith defined spatial margin as a line or boundary signifying the end of profitability or viability, thus separating profitable from loss-making space (Smith, David M, 1981).

There are minor misconceptions in the works of Weber's original assumptions. Markets can no longer be assumed to be located where the raw materials are orientated due to the facts that there have been changes over time and space in demand, production methods, and price; there are different transport systems; perfect competition is not a valid assumption (as indicated by the new growth theory); and decisions made by industrialists may not always be rational-as it also depends on which is more important, the market or the labor. Overall traditional models cannot cope with the volatile global system in which we endure and in which technological change is both rapid and endemic.

2.3 Measuring Population Growth

Population growth theory discusses demographic perspectives that provide broad answers to the following two questions: (1) What are the causes of population growth or change? and (2) What are the consequences of population growth or change (Weeks,

John Robert, 1998)? Population growth can arise from increased births, decreased deaths, or increased net in-migration.

Trends of population redistribution in the U.S. during the final half of the 20th century were extremely intricate (Johnson, Kenneth M., Alfred Nucci and Larry Long, 2005). Throughout the period, metropolitan growth was prevalent while growth patterns in rural (nonmetropolitan) areas were highly inconsistent (Johnson, Kenneth M., Alfred Nucci and Larry Long, 2005). When economists were studying the Census Bureau population estimates, they discovered the following highlights: the nonmetropolitan turnaround of the 1970s, the renewed metropolitan growth of the 1980s, and the rural rebound of the 1990s (Johnson, Kenneth M., Alfred Nucci and Larry Long, 2005). From 1994 to 1995, nonmetropolitan migration rates stalled and continued until the first year of the new century, in which an increase was sparked (Johnson, Kenneth M., Alfred Nucci and Larry Long, 2005). To understand how this pattern of population change came about, the role of net migration must be understood. Literature of the 1990s that documented the rural rebound was not adequate at providing a supportive explanation towards why the higher population gains reflected in each subgroup of counties resulted from substantially higher net migration gains (Johnson, Kenneth M., Alfred Nucci and Larry Long, 2005).

One could argue economics of increasing returns to scale, studies of economic agglomeration, and empirical literature on the determinants of growth are topics that are placing geography and population mobility back on the map (Pritchett, Lant, 2004). There are many intricate and in-depth empirical forms of evidence that advocate that

economic benefits to agglomeration exist and have quantitatively significant effects on the migration of labor and the location of industry (Hanson, Gordon H., 2000). This combination has led to the use of the new formal apparatus for addressing fundamental questions like "what determines the number and location of cities" (Fujita, M., Paul Krugman and A. J. Veneables, 1999)? A second element of this interest in agglomeration economies is the continued interest in regional economies and the ascent and decline of populations of cities and regions within countries. State level movements in employment in the USA exhibit convergence in real wages but great variability in population growth rates across states persists (Blanchard, Olivier and Lawrence Katz, 1992).

Some economists tend to believe that there are many unresolved issues facing the future empirical work on geographic concentration and their development of study. Some chief questions that are probed would be whether learning across firms and workers drives agglomeration, or whether agglomeration drives learning. Many independent studies have found evidence that suggests that there are human capital spillovers across workers in the same city, localized knowledge spillovers in the innovation process, and regional cost and demand linkages between firms. There has been little research to approximate the relative impact of these dissimilar effects (Hanson, Gordon H., 2000). A few studies have examined the role of both productivity changes and demand changes in simultaneously determining population sizes and real estate prices (Glaeser, Edward L., 2000).

In this study, the population growth factor is measured by in-migration rate per 1000 people, out-migration rate per 1000 people, and average annual rate change in population density.

2.3.1 Theoretical Framework for the Population Growth

The theories related to location choice by individuals are usually termed in-migration theories. The purpose of this section is to provide an overview of the methods in which social scientists define and conceptualize the migration process. These theories explain how people make location decisions.

Weeks (Weeks, John Robert, 1998) defines migration as a permanent change in residence in which all migrants are movers, but not all movers are migrants. He stated that with reference to the individual's area of origin, that person is an out-migrant, whereas the individual becomes an in-migrant with respect to his/her destination. Weeks wrote that if an individual moved from one country to another, he or she becomes an international migrant; this is defined as an emigrant in terms of the area of origin and an immigrant in terms of the area of destination. The difference in characteristics between internal and international migration is significant because the incentive or motivation to move may have to be to a great extent, stronger, and the cultural impact of international migration is generally greater than that implicated in internal migration (Weeks, John Robert, 1998).

The explanatory theories of why people choose to migrate are usually parallel; therefore, the theoretical approach has been used to explain international migration can also explain internal migration as well.

2.3.1.1 Classical Theories of Migration

The push-pull theory, which has been one of the most frequently heard and used explanations for migrations throughout literature reviews, elucidates that a number of people move as they are pushed out/away from their former locality, whereas others move because they have been pulled or attracted to someplace (Weeks, John Robert, 1998). Push factors are circumstances that cause an individual to leave somewhere. It might be high unemployment rate, heavy taxation, uncongenial social environment, poverty, or generally poor socio-economic conditions; it might be a war or famine or unsustainable political conditions. It might be an unattractive climate, or it may be family problems or situations. Pull factors are those factors which tend to draw migrants to a specific place. Pull factors can include higher wages, more job opportunities, lower unemployment, or a general booming economy with lots of perceived opportunities. It might be a stable political condition, an availability of land or pleasant climate, an availability of housing, lower crime rates, or simply an open society.

Ravenstein (1989) concluded that pull factors were stronger than push factors. Most migrants travel short distances. Rural inhabitants are more migratory than inhabitants of in urban areas. Males are less migratory than females in internal migration and more common in international migration. The volume of migration increases with

development of industry and infrastructure. Large towns owe more of their growth to migration than natural increases, and the main causes of migration are economic (Siegel, Jacob S. and David A. Swanson, 2004, Weeks, John Robert, 1998).

Stouffer (1960) wrote that the strength of movement amid two places is dependent on the quantity of intervening opportunities among them. The most important feature of the Stouffer model is the nature of places or number of opportunities of places. The number of opportunities is more important than distance between two places (migration origin and destination). Therefore, according to the Stouffer theory, the number of people moving over a given distance is directly proportional to the number of opportunities at that distance and is inversely proportional to the number of intervening opportunities. People will migrate from one place to another based on the real, or the perceived, opportunity at the destination place (Weeks, John Robert, 1998).

Lee (1966) tries to explain the factors affecting migration in terms of the positive and negative characteristics of both the origin and destination places. Lee believes that there are two major conclusions that can be generalized about migration: (1) Migration is selective-that is, not everyone migrates. Only a selected portion of the population is subjected to migration; and (2), the heightened propensity to migrate at assertive stages of the life cycle is significant in the selection of migration (Weeks, John Robert, 1998).

Zelinsky (1971) attempts to provide a theoretical foundation of demographic transition employed with spatial dimensions in which he links the three elements of population changes in his hypothesis of the mobility transition; the three elements are migration, fertility, and mortality (Skeldon, Ronald, 1977). There were five stages in

Zelinsky's model in which the foundation was based (AngliaCampus, 2006, Zelinsky, Wilbur, 1971). From these two citations, they are explained as follows. The first stage in the model explains that in a pre-industrial society there is little residential migration and limited movement between areas. The second stage of the model illustrates a premature transitional stage of considerable rural-urban migration and the colonization of new lands with the coupled growth of longer distance migration (often in the form of emigration). In the third stage of the model, rural-urban migration persists, and there is a fast rise in-migration amid cities. In the fourth stage of the model, rural-urban migration may continue, but at a markedly reduced rate; residential migration remains high, but in the form of migration in and between cities rather than emigration. There may be some immigration of unskilled workers, and highly trained professional workers may be exchanged between countries as a result of the operations of multi-national companies The final stage of the model implies that advanced societies will have almost exclusively inter- or intra-urban migration although new technology will decrease the requirement for migration. There is a reduced need for a number of types of circulation, and mobility amid and inside countries may be affected by the state's legislation (AngliaCampus, 2006).

2.3.1.2 Economic Theories of Migration

Economic theories of migration can be divided into the following two groups: (i) flows of migration: neoclassical economics theory, new economics of migration theory,

dual labor market theory, and world systems theory; and (ii) perpetual repeated flows: network theory, institutional theory, and cumulative causation.

Neoclassical economics macro theory argues that migration is the process of labor modification caused by geographic differentiations in the supply of and demand for labor by applying the classical supply and demand model towards migration. Disparity in wages creates a flow of labor from a low wage country (region or area) to transfer to a high wage country (region or area), which underlies Ravenstein's conceptualization of push factors (low wages in the region of the origin) and pull factors (high wages in the destination region) (Weeks, John Robert, 1998).

Capital investment directional flow is from the capital-rich country to capital-low country (Magarati, Maya, 2004). One of the forms of capital that moves is human capital, in which highly skilled workers go from capital-rich to capital-poor countries (Magarati, Maya, 2004).

Neoclassical economics micro theory is geared toward the level of individual rational actors who act on decisions to migrate based upon a cost-benefit calculation that signifies a positive net return to movement (Massey, Douglas S., et al., 1993). Migration is seen as an investment in human capital at the individual level; this investment is one in which individuals can improve their economic productivity and their overall standard of living as well (Weeks, John Robert, 1998). Neoclassical economic micro theory is well known by the human capital theory of migration. People make decisions to migrate to areas where the greatest opportunities exist The area the individual migrates towards may not have the current highest wages, but rather is the place where the individual

migrant believes that in the long run, his/her skills will earn the best income (Weeks, John Robert, 1998). These skills may include education, experience, training, and language capabilities (Weeks, John Robert, 1998). In this approach, human capital characteristics that raise the potential benefits of migration, and individual, social, or technological factors that lower costs, will lead to increased migration. Dissimilarities in wages and employment rates are significant variables in which government influences migration through policies that affect them (Russell, Sharon Stanton, 1995). An example would be through the development of policies that raise incomes at the point of origin, decrease the probability of employment at destination, or increase the costs of migration (Russell, Sharon Stanton, 1995).

New economics of migration theory deems that the individual is the proper unit of analysis (Weeks, John Robert, 1998). However, the new household economics of migration approach argues that a choice about migration is frequently made in the context of what is paramount for an entire family or household (Weeks, John Robert, 1998). This approach agrees to the suggestion that people act collectively, not only to maximize their expected income, but also to curtail risk (Weeks, John Robert, 1998). It examines migration as a family strategy to diversify sources of income, minimize household risks, and conquer barriers to credit and capital (Russell, Sharon Stanton).

"Migrating members of the household have their journey subsidized and then remit portions of their earnings back home" (Weeks, John Robert, 1998). Without unemployment insurance, welfare, and banks to borrow or invest money, remittances from migrant family members can cornerstone the household's economic security

(Weeks, John Robert, 1998). In societies with weak institutions, remitting portions cushion households against blows associated with the inherent risk (Weeks, John Robert, 1998).

Economic development in origin areas of or equalization of wage differentials will not necessarily reduce pressures for migration (Russell, Sharon Stanton, 1995). Governmental influence toward migration is best regarded as the use of policies toward insurance, capital, futures markets, and through income distribution policies that influence the relative deprivation of certain groups, and in so doing, their tendency to migrate (Russell, Sharon Stanton, 1995).

Dual labor market theory presents an explanation of the creation of opportunities for migration. It suggests that in developed regions of the world, there are fundamentally two types of job markets. The primary sector employs well-educated people, pays great salaries, and offers job security and benefits. Low paying wages, unstable working environments, and the lack of reasonable prospects for advancement characterizes the secondary labor markets (Weeks, John Robert, 1998). As a result, the primary sector labor market is a capital-intensive market characterized by higher wages, jobs security, and the attraction for a possibility of occupational mobility (Magarati, Maya, 2004). The secondary labor market is a labor-intensive market characterized by low wages, unstable conditions, and a lack of occupational mobility prospectus (Magarati, Maya, 2004).

In the past, racial and ethnic minorities, women, and teenagers were hired in the secondary labor market jobs. However, in the past few decades, as generally known, women and racial and ethnic minority groups have gradually positioned themselves into

the primary sector as racial and gender equality has been advocated. Simultaneously, the low birth rate has reduced the supply of teenagers available to work; not to mention, stiff and strict penal laws prohibit teenagers under certain age for employment. Nonetheless, the lower echelon of jobs still necessitates somebody willing to do the work, and immigrants from developing countries are usually recruited in that these individuals are usually seeking these type of jobs – either actively (as in the case of agricultural workers) or passively (the diffusion of information that such jobs are available) due to reasoning of their justification (Weeks, John Robert, 1998). Structural inflation is evaded because it keeps from increasing entry wages of native workers and maintains labor as a variable factor of production. Employers seek migrant workers who are paid a low-wage (Russell, Sharon Stanton, 1995). The labor demands of modern industrial societies are not explicated by push factors (low wage or high unemployment in the sending countries) but by pull factors (a constant want of foreign workers) (Magarati, Maya, 2004).

In this model, migration is included, especially international migration. It is demand-based and commences through recruitment policies of employers or government in destination areas. Among origin and destination areas, wage differentials are not necessary or sufficient conditions for migration. The decision for government policy intervention to affect migration is thus limited (Russell, Sharon Stanton, 1995).

Core-Periphery theory contends that, from the sixteenth century (and as part of the Industrial Revolution in Europe) the world market has been developing and expanding into a set of a core nations (those with capital and other formed of material wealth) and a set of peripheral countries (the rest of the world). The world markets have

become dependent on the core, and the core countries have penetrated the peripheral countries seeking out land, raw materials, labor, and new consumer markets (Weeks, John Robert, 1998).

As land, raw materials, and labor in areas of origin are drawn into the world market economy and traditional systems are disrupted, international migration has been created. To accompany globalization and further facilitate international migration, transportation, communications, cultural and ideological links have been noted to play a role in the process of doing so (Russell, Sharon Stanton, 1995). Russell believes international migration is affected more by policies toward overseas investments and toward the international flow of capital and goods than by wage or employment differentials between countries. However, the directional flow of migration does not have a tendency to be cited as random. Specifically, peripheral countries are perhaps more likely to convey migrants being refugees to core nations in which they have had the greatest contact or relationship with. This form of contact can be economic, political or military (Russell, Sharon Stanton, 1995).

Network theory emphasizes that migrant networks decrease the costs and risks of migration; this will increase the likelihood of movement (Russell, Sharon Stanton, 1995). Migrants establish interpersonal links through ties, kinship, friendship, and shared community origins that connect migrants, former migrants, and non-migrants in origin and destination areas (Massey et al 1993:449). Their likelihood of movement is increased due to the lower costs and risks of movement and increase in expected net returns to migration (Massey et al 1993:449). When initiated, migration maintains itself

through the diffusion process until everyone who might migrate has had a chance. (Massey et al 1993:449). This kind of migration, in some developing countries, eventually may become observed as a custom or rite of passage into adulthood for community members rather than a response to supply and demand conditions (Weeks, John Robert, 1998). A governmental policy which makes international flows relatively insensitive to policy interventions usually facilitates such network development (Russell, Sharon Stanton, 1995).

Institutional theory emphasizes that once international migration has started, organizations that are private and voluntary develop to support and sustain the movement of migrants (Russell, Sharon Stanton, 1995). This may consist of a variety of legal and illegal services that, for example, provide transport, labor contracting, housing, legal and other services that have proven difficult and complex for governments to catch or regulate (Russell, Sharon Stanton, 1995).

When in transition, migration may also be responsible for institutions that develop specifically to facilitate the continued flow of immigrants. These organizations may offer a variety of services, from humanitarian protection of exploited persons to more illicit operations, such as smuggling people across borders and providing counterfeit documents (Weeks, John Robert, 1998). These organizations assist in enabling migration in the face of government endeavors to limit the flow of migrants (Weeks, John Robert, 1998) .

Cumulative causation theory holds that, by changing the social context of subsequent migration decisions, the establishment of international migration streams

creates feedbacks that make additional movements more likely (Russell, Sharon Stanton, 1995).

This point of view suggests that each act of migration changes the likelihood of subsequent decisions about migration because migration has an impact on the social environments in both sending and receiving regions. In the sending countries, the return of remittances augments the income levels of migrants' families relative to others in the community. This may contribute to an increase in the motivation of other households to send migrants. Migrants themselves may become part of a culture of migration and become likely to move again, escalating the overall volume of migration. In the receiving country, in certain occupational sectors, the entry of immigrants may create labels such as "immigrant jobs," which reinforces the demand for immigrants to fill those frequently (Weeks, John Robert, 1998).

Among the factors affected by migration are the distribution of income and land; the organization of agricultural production; the values and cultural perceptions surrounding migration; the regional distribution of human capital; and the "social labeling" of jobs in destination areas as "immigrant jobs." Again, once a "migration system" has developed, it is often resistant to government policy intervention.

"The International Union of Scientific Studies of Population (IUSSP) Committee concludes that theories regarding the initiation or perpetuation of migration need not and should not be viewed as contradictory or mutually exclusive" (Papademetriou, Demetrios G. and Philip L. Martin, 1991, Russell, Sharon Stanton). Rather, "it is entirely possible that individuals engage in cost-benefit calculations; that households act to diversify labor

allocation; and that the socioeconomic context within which these decisions are made is determined by structural forces operating at the national and international levels" (Papademetriou, Demetrios G. and Philip L. Martin, 1991, Russell, Sharon Stanton).

2.3.1.3 Some Other Approaches

The theories summarized above do not address the many types of movements that result more directly from political factors (violence, repression, human rights violations, ethnic tensions) or environmental factors, although both may have economic and social underpinnings. One recent empirical effort to examine the causes of official refugee movement across countries (Edmonston, Barry, 1992) finds that greater threats of violence (i.e., oppression, minority struggle, and civil violence), more authoritarian government structures, and worsening socioeconomic development conditions are all associated with increased refugee emigration. However, the study concludes that there is no clear, single cause of refugee movement in any of the countries studied. As with more voluntary movements, multiple-cause explanations are required.

Awareness of environmental issues and migration has grown over recent years. Therefore, there are persistent efforts to investigate the links between the two. However, more awareness has been directed towards migration effects on the environment than to environmental causes of migration (Suhrke, Astri, 1994). Suhrke discerns two opposing perspectives, which are the minimalist view and the maximalist view (Russell, Sharon Stanton). The minimalist view holds that environmental degradation is essentially a contextual variable that affects the decision to migrate, but is only one of a cluster of

causes for movement, while the maximalist view, in contrast, sees environmental degradation as a direct and significant cause of out-migration (Russell, Sharon Stanton).

2.3.2 Summary for Population Growth Measurement

In this study, the measures of population growth take account of average annual rates of change in population density, in-migration rates, and out-migration rates. Population growth has interdependent or simultaneous relationships with economic growth. Therefore, non-recursive structural equation modeling is appropriate. Based on divergent literature, migration is an important component of population growth of the United States. Therefore, for this study, the population growth factor depends, not only on economic growth, but also on demographic characteristics, such as natural increase, median age, race, and gender; socioeconomic level of 1990 such as housing dimension, education dimension, and economic opportunities; and gravitational attraction to large cities. Because of agglomeration effects, population growth is also different in urban and rural areas, as well as coastal and non-coastal areas. Consequently, the non-recursive structural equation model should concern differences in rural, urban, coastal, and non-coastal areas. The best ways to see these differences is through the use of cluster analysis and GIS spatial analysis.

2.4 Combinational Studies of the Determinants and Consequences of Migration

2.4.1 Arthur C. Mead Model: A Simultaneous Equations Model of Migration and Economic Change in Nonmetropolitan Areas

Arthur C. Mead's (1982) model is a great example of the simultaneous equations model of migration and economic changes in nonmetropolitan areas in the United States. McCarthy and Morrison (1977) formed the idea that the reversal of the flow of net migration from nonmetropolitan to metropolitan areas has a number of causes and a number of consequences. This was empirically confirmed by Mead. These determinates and consequences of migration tend to be self-reinforcing and cumulative (Greenwood, Micheal J., 1975b). Mead employed a four equations model for the study of 69 nonmetropolitan state economic areas from 1960 to 1970. The dependent variables in the model were in-migration, out-migration, non-agricultural employment growth, and median wage income growth. An important factor in his model development was that Mead modified the gravity of migration and the highway mileage separating the center of the Sphere of Metropolitan Statistical Area (SMSA) (from the major urban center in the Non-Metropolitan Area [NMA]) and added this behavioral content to the explanatory variables in each 4 equations. This gravity variable measures the proximity of the SMSA to the NMA and the potential interaction between the metropolitan and nonmetropolitan areas (Mead, Arthur C., 1982). Gravity is expressed as the strength of distance between two areas. A conclusion based upon Mead's research can be generalized by stating that there is a significant link between the patterns of economic and demographic change

within a nonmetropolitan area. Mead's result also indicates that migration affects and is affected by employment and income growth. Mead indicates that the interdependence of migration and employment growth alters over time. Examining the period prior to and after the "rural-urban turnaround," Mead stated that a push-pull model of migration is appropriate for the turnaround period and that during this period, businesses were locating in retort to low wages, low property taxes, and labor availability. Mead suggests that although wage income appears to be converging interregionally, it is essentially diverging within regions near SMSAs in respect to the equilibrium and disequilibrium hypotheses. When analyzed within a tight scope boundary, the interdependence between migration and economic changes causes questions about the relative significance of economic and noneconomic factors in the migration decision. Mead still insisted that economic factors are the most imperative conception when explaining net migration rates for nonmetropolitan areas (Campbell, Charles A, 1985, Mead, Arthur C., 1982).

2.4.2 Other Combinational Studies of Migration

In the earlier scholastic achievements of Herbert S. Parnes and Ruth S. Spitz (1969), they studied the workers willingness to change their job and found it depended on either the workers satisfaction with his job or with higher wage or salary. They argue that the probability of actual movement depends on the satisfaction of the job, characteristics of workers, relevant characteristics of the job, job security, and labor market characteristics. However, labor mobility depends on workers' willingness to change their job, which is related more to job satisfaction than to income differentials.

Parnes and Spitz wrote that labor mobility is a more complex phenomenon than imagined on the basis of conventional labor market theory. They conceive of labor as a more or less homogeneous and fluid factor continuously flowing in the direction of net economic advantage. Based on their conclusion, mobility affects labor markets and is affected by labor markets, and mobility is more of a response to job openings than to income differentials (Parnes, Herbert S. and Ruth S. Spitz, 1969).

Studies performed by Gallaway (1967) and Raimon (1962) imply that there is no conflict with the studies of Parnes and Steins, but wage differences are important for labor mobility. By calculating behavioral content to the population variables, the modified gravity model employed is perhaps one of the most significant contributions to in-migration studies (Greenwood, Micheal J., 1975b). It could be argued that since destination population size is a proxy for the size of labor market, the larger the magnitude of the labor market, the higher the number and type of job opportunities. On the other hand, it can also be argued that the larger the size of the origin population, the greater the quantity of individuals who may migrate based on any given impetus (Greenwood, Micheal J., 1975b).

In the 1960s, two alternative hypotheses were introduced about the relationship between metropolitan employment growth and migration. The first hypothesis assumes a perfectly elastic labor supply and suggests that employment demand drives migration. (Al-Dakhil, Khalid I., 1997). Blanco, Lowry, and Mazek all performed studies which indicated some support for the first hypothesis, but their claims never gave a convincing rationale for a perfectly elastic labor supply curve (Al-Dakhil, Khalid I., 1997). In

opposition to this view, Sjaastad found unemployment not to be statistically significant in regressions on migration (Mazek, Warren F., 1969). This contrary result has been found in many studies relating to the U.S.

Blanco's (1963, 1964) approach in analyzing migration and the measure of employment opportunity (average unemployment over time) utilized a single equation model. This single equation model studied by Blanco created a bias regression result. The reason is an endogeneity problem. He concluded that unemployment affects migration and that there is a reverse feedback of migration on unemployment (Mazek, Warren F., 1969). Lowry (1966) also used a single equation approach to studying migration and demand for labor. His conclusions were the same as Blanco; his results were also biased. Mazek performed studies on migration and unemployment where he used the same techniques, but he focused on differences in the migration of two subgroups – white and nonwhite laborers. He found that migration is inversely correlated to potential unemployment. Worker income varies inversely with unemployment levels, and workers have a tendency to equalize income by migrating from locations with higher unemployment rates to locations with lower unemployment rates (Muth, Richard F., 1970). One problem that the three noticed was that a single equation model frequently overlooks a critical type of reverse causality: while migration is a function of unemployment, net out-migration (immigration) reduces (increases) unemployment (Mazek, Warren F., 1969). Because of the lack of appropriate data, they could not use a simultaneous equation model approach to correct the reverse feedback problem.

A perfectly elastic labor demand and employment driven by migration are the fundamental assumptions of the second hypothesis (Al-Dakhil, Khalid I., 1997). Studies directed towards this hypothesis were supported by Borts/Stein and tested and reconciled by Muth. The Borts-Stein method was parallel to the small country-rest-of-the-world models of international trade. Their studies consisted of three types of goods: labor-intensive domestic goods consumed at residences; capital-intensive goods produced for export (of which only a fraction is consumed at home); and imported final goods. Borts-Stein assumes that labor and capital are the inputs in the productive process, but all capital goods are imported (Goldstein, Gerald S. and Leon N. Moses, 1973). An increase in the labor supply which results from migration will push the labor supply shift to the right and increase the quantity of labor (employment). Migration may intensify an increase in investment expenditure of local industries. This causes the demand curve to shift upward, and wages will increase along with the quantity of labor.

Muth reconciled the Borts and Stein ideas and made one of the first efforts towards explaining regional growth in the context of the simultaneous equation model. Muth used 1950 cross-sectional data to study the relationship between migration and the growth of employment in cities and how this relationship is different for various regions. Muth's results suggest that migration not only affects, but is affected by employment growth (Muth, Richard F., 1970). Muth measured the precise degree of response of migration to employment growth. He concluded that every 100 jobs attract nearly 60 to 70 migrants, and every 100 labor force migrants result in about 100 jobs (Muth, Richard F., 1970). The estimated elasticity of migration with respect to employment growth was

implausibly high (Muth, Richard F., 1970). This conclusion made him realize that the Borts and Stein hypothesis of perfectly elastic metropolitan labor demand agreed with his studies. Muth agrees that migration and employment growth are mutually dependant. Muth's work still signifies an important contribution to the migration literature. It has been suggested that Muth has even taken migration and employment relationships out of the distinct equation box and placed it into an appropriate framework of a simultaneous equation model (Mazek, Warren F. and John Chang, 1972).

L.D. Olvey (1970), Okun (1968), and Greenwood (1973, 1975) changed the simultaneous equation model approach by introducing the concept of structural equations. The structural equations are for jointly dependent variables other than for migration and employment. L.D. Olvey studied migration and employment change in 56 large sphere of metropolitan statistical areas (SMSAs) from 1955 to 1960 using a simultaneous equation model. In his studies, in- and out-migration are used separately instead of net migration, which was used in Muth's model. Wages are exogenous variables similar to the way Muth used median income of families as a wage. Olvey and Muth's findings both conclude that migration and employment growth are dependent of each other. Olvey's in-migration equation includes the employment growth, but the out-migration equation excludes the employment growth (Greenwood, Micheal J., 1975b).

Unlike Olvey or Muth, the simultaneous equation models of Okun and Greenwood assume that income growth is an endogenous variable instead of an exogenous variable and introduced structural equations into the model that try to explain urban economic growth and migration over the 1950-60 and 1960-70 periods.

Okun used data collected from 1940-1950 to study net interstate migration using a simultaneous equation model. He introduces an endogenous variable for change in service income per capita (Greenwood, Micheal J., 1975b). His conclusions were that net in-migration and service income per capita are mutually dependent. Individuals are attracted to a destination where there is a higher income, and net in-migration encourages increase in service sector income per capita. Okun strongly believes in the selective nature of migration in terms of determining the consequences of regional migration.

Greenwood's model is estimated in two different time periods, 1950-60 and 1960-70, with the standard metropolitan statistical area as basic urban growth using a simultaneous equations model which consists of 14 equations: 9 structural equations and 5 identities. Endogenous variables include the rate of civilian labor force out-migration, the rate of civilian labor force in-migration, the rate of median income growth, the rate of unemployment growth, and the rate of natural growth of the civilian labor force. In his model, in-migration and out-migration are expressed separately and are distinct to SMSA and NMA. His results suggest that in-migration of the civilian labor force encourages larger employment growth in urban areas, which confirm the findings of Kuznets, Perloff, and others that followed his research. His findings also suggest that interregional migration may not lead to income convergence, which supports Sajaastad's (1961) assumption. Since migratory behavior of the civilian labor force members is extensively influenced by the augmentation of economic opportunities, the development of economic growth in urban areas has a propensity to be self-reinforcing. The evidence does not sustain the hypothesis that out-migration promotes greater income growth but does

suggest that regional income differentials are lessened through interregional migration. Out-migration, on the other hand, does tend to promote greater income growth. Out-migration has a propensity to relieve unemployment in sending localities. The income-level variable is negative and significant in the income-change equation for each period, suggesting that high-income areas do experience lower rates of income growth than low-income areas. When the 1950s and 1960s are compared, Greenwood's results support significant structural changes in the determinants and consequences of migration (Greenwood, Micheal J., 1975b).

Persky and Kain (1970) studied how net migration from the nonmetropolitan Deep South (Alabama, Arkansas, Georgia, Lousiana, Mississippi, and South Carolina) affects the natural increase of the region's population and the increase of employment for 1950-1960. The racial composition of the net flow of migrants is dependent on the racial distribution of employment. By discovering the causes of the racial composition of migration, they explore the likely results of efforts to expand and open southern employment (Persky, Joseph J. and John F. Kain, 1970).

Greenwood (1976) also estimates a simultaneous equation model that includes racial composition of migration between 1955 and 1960. Greenwood's results imply that white in- and out-civilian labor force migration have larger impacts on white employment change and unemployment than non-white in- and out-migration have on non-white employment change and unemployment. The results of Greenwood were consistent with the pragmatic tendency for nonwhite migration flows to contain bigger percentages of unemployed people than white flows (Greenwood, Micheal J., 1976).

McCarthy and Morrison (1977) theorized, and Mead (1982) empirically confirmed, that the reversal of the flow of net migration from nonmetropolitan to metropolitan areas had many causes. Greenwood and Hunt (1984) have estimated a model of migration and employment for each 171 U.S. regions with emphasis on the 57 largest metropolitan areas using time series data from 1959 to 1975 (Greenwood, Micheal J., 1975a). The intention of their investigation was to assess the migrant attractive power of another job and the number of local jobs attributable to another migrant. They discovered that incremental employment primarily went to the northeast and north central regions. This was because the share of national employment was very large for these areas. Migrants were also drawn away from these regions and attracted toward the South and the West where an additional net in-migrant to the area is accountable for more than one supplementary job in the area. Therefore, migrant induced employment went to these regions of net in-migration at the expense of the regions of out-migration. The studies would afterward substantiate and support the earlier research of Muth.

Lowry and others believed that home (origin) economic conditions do not have a significant effect toward outflow. Schlottmann & Herzog (1982) reexamined this relationship and found contradictory evidence. Their results indicate the home (origin) economic conditions and demographic characteristics of resident population have a significant effect/influence towards the decision for migration as well as both magnitude and size of outflow. Schlottmann & Herzog were concerned with the "inclusion of autonomous population movements between regions – those associated with either military service or college attendance – as labor force migrants subject to analysis"

(Herzog, Henry W. and Alan M. Schlottmann, 1982, Schlottmann, Alan M. and Henry W. Herzog, 1982). They also analyzed labor force flows disaggregated into primary, return, and non-return repeat migrants[6]. For their modeling specification, for both the primary and repeat migration decisions, the dependant variable is set to equal one if an interstate move occurs and zero if otherwise for an individual at-risk to migration. The dependant variable is given the value of one if a return move occurred (zero if otherwise) for the return or move elsewhere decision of repeat migrants. Independent variables are comprised of personal characteristics and economic-environmental factors such as employment growth, levels of taxes and welfare benefits, and climate. Their results indicate that economic conditions affect outflow – especially additional unemployment that has a significant effect to primary – repeat and non-return repeat migration.

Greenwood, Hunt, and McDowell (1986) examined net employment migration and the attractive power of incremental job and employment changes, for 17 consecutive years, using a simple simultaneous system. Their study consists of 3 behavioral equations for rate of net migration of employed persons, rate of employment change, and rate of change of average annual earnings. The net migration equation includes explanatory variables of employment, wage, and location specific amenity variables. Their location specific amenity variables were degree days (temperature range), average humidity, average wind speed, average number of clear days per year, percentage of land area in national forests and grassland, and a dummy that indicates the presence or

[6] Quote: " Primary migrants represent workers living in their state of birth in 1965 but not in 1970 and assumed to be making initial move (across state boundaries). Return migrants are workers not living in their birth states in 1965 but doing so in 1970. Non-return repeat migrants are workers living in their birth states in neither 1965 nor 1970.

absence of seacoast (Greenwood, Micheal J., Gary L. Hunt and John M. McDowell, 1986). Unlike Muth, their study did not find a perfectly elastic demand for labor. They presume there are many factors that could affect the demand for labor, and the labor demand curve downward could be sloping or perfectly elastic. Under their model specification, employment change depends on net migration, an additional employed migrant, and destination. The wage equation includes human capital variables, physical and financial capital variables, source of incomes, investment (social infrastructure, housing), price of locally produced and consumed goods and services, and achievement of scale and agglomeration economies. They also estimated the temporal pattern of the cross-sectional estimates of the migrant attractive power of an incremental job (Greenwood, Micheal J., Gary L. Hunt and John M. McDowell, 1986). They found that in an average year, two extra jobs attracted about one additional net migrant; that one additional net migrant has a direct effect on area employment of almost 1.4 jobs. The migrant-attractive power of another job rises during national upswings and falls during downswings; however, during national expansions, migrants have a less direct impact on area employment (Greenwood, Micheal J., Gary L. Hunt and John M. McDowell, 1986).

Eldev-Ochir and Campbell (Eldev-Ochir, Erdenechimeg and Charles A Campbell, 2004) studied migration and economic changes in Mississippi using a simultaneous 4 equation model and GIS raster modeling from 1995 to 2000 for the state of Mississippi. By applying theoretical characteristics and combinational studies from reviews of journals and literature reviews, she adds new concepts to the previous modeling techniques. The study focused on comparing the result of the simultaneous equation

model with that of the GIS raster model and examining the two for similarities. It was concluded from the investigation of Mississippi data that, if metropolitan statistical areas (MSAs) are located relatively near another MSA, the nonmetropolitan statistical areas (NMSA) counties that are located between these areas will not develop as fast as a county that is located some distance away from a MSA area. When counties are located near a MSA area, most people have a tendency to work in the MSA area. Hence, the NMSA counties will not grow as fast in employment and economic growth. If MSA areas are located at a greater distance from the next MSA area, then NMSA counties located within or very close to the sphere of the MSA will develop a higher growth rate of employment due to migration, and employment growth rate will have more attraction to move in. Socioeconomic and demographic variables have a significant effect on both migration and economic growth.

The results from the estimations show that the models are highly significant in explaining the relationship between migration and economic changes in Mississippi for 1995-2000, and in NMSA based on Mississippi's data. The models illustrate because people migrate in response to economic growth (wage and salary employment growth and wage and salary disbursement growth). The economy also develops due to migration. In-migration into NMSA counties has, ceteris paribus, a significant positive effect on wage and salary employment growth and wage and salary disbursement growth. This means that in-migration is creating many job opportunities for Mississippi overall and for NMSA counties of Mississippi. Demographic, socioeconomic, and cost variables are important in explaining the relationship between migration and economic growth.

2.5 Which Theories or Approach Are Best?

The reasons for socioeconomic development are complex, broad, and dynamic. Socioeconomic development affects and is affected by both the individual and the societal levels simultaneously. Therefore, it is impossible to explain or evaluate socioeconomic development by any single theory, since each theory has a particular focus and perspective. As a group, the previous studies provide important clues that can be used in trying to generalize to a systematic process.

Hanson (2000) suggests that there are three pressing but unresolved issues important in tackling future empirical work on geographic concentrations. The first concerns why so little has been done toward estimating the relative impacts of the different individual effects found with simple simultaneous models. His answer is that there have simply been few efforts at estimating within the complex framework of structural economic models with nested hypotheses which would be necessary to examine the relative effects of individual factors on spatial agglomeration (Hanson, Gordon H., 2000).

Secondly, Hanson argues that theoretical models have a propensity to focus on a single stimulus for geographic concentration, in isolation from other factors. Hanson believes that more ambitious models should be developed, and more aggressive studies should be implemented where data is a function of the objective; such empirical work is plagued by a simultaneity dilemma (Hanson, Gordon H., 2000).

The third pressing issue is that Hanson argues that to a great extent, the empirical work on economic geography actually has a small geographic component. The standard

approach in much of the literature is to treat regions as distinct and physically separate small open economies, disregarding any interregional linkages that may exist (Hanson, Gordon H., 2000).

2.6 Structural Equation Modeling Analyzing Approach

Most statistical and econometric models utilize individual observations. Structural equation modeling (SEM) procedures emphasize covariances rather than cases[7] (Bollen, Kenneth A., 1989). SEM minimizes the discrepancies between the sample covariances and covariances predicted by model, instead of minimizing sum of squared differences of the predicted/fitted and observed dependent variable for each case as in regression, ANOVA or residual analysis (Bollen, Kenneth A., 1989, Kline, Rex B., 1998). The covariance matrix of the observed variables is a function of a set of parameters, and according to Bollen, that is the fundamental hypothesis for the procedures behind structural equation. Thus, the hypothesis is stated to be $\Sigma = \Sigma(\theta)$. Theta (θ) is a vector that contains the model parameters, Σ (θ) is the covariance matrix written as a function of θ, and Σ (sigma) is the population covariance matrix of the observed variables. When the model is constructed with careful accuracy, and if the parameters are known, then the population covariance matrix can be reproduced with precision (Bollen, Kenneth A., 1989).

[7] Individual cases that are outliers can severely affect covariances and estimates of parameters. Thus, with these techniques, researchers still need to check for outliers. In addition, in many cases (e.g., regression models) the minimizations based on individuals and minimizations based on the predicted and observed covariance matrices lead to the same parameter estimates. (Bollen, Kenneth A., 1989)

The term “structural” represents the assumption that the parameters are not just descriptive measures of association but also reveals an invariant causal relation. Structural equation modeling is not a solitary statistical method but instead refers to a family of interrelated procedures (Kline, Rex B., 1998). It can generally be stated that the structural equation model has three mechanisms. These components are path analysis, the conceptual synthesis of latent variable and measurement models, and general estimation procedure (Bollen, Kenneth A., 1989).

Sewall Wright is a renowned and well noted biometrician and also the inventor of the method of path analysis. He also is credited with discovering the inbreeding coefficient and F-statistics. Path analysis employs regression models to test the fit of the correlation matrix against two or more causal models being evaluated. Path analysis requires the usual assumptions for regression. Path analysis is defined as structural equation modeling when the variables in the model are latent variables that are measured by multiple observed indicators.

There are three components to path analysis. They are the path diagram, the equation relating correlations or covariances to parameters, and the decomposition effects. The path model is a diagram connecting independent, intermediary, and dependent variables. The brief definition for a path diagram states it to be a pictorial representation of a system of simultaneous equations. This representation reflects the relation between all variables as well as disturbances that are uncorrelated with each other. In order to use the path diagram, a researcher must first put forward a set of rules for writing the equations that relate the correlations (or covariances) of variables to the

model parameters; this represents the second aspect of path analysis. The final step is solving these equations for the unknown parameters, and substituting correlations and covariances for their population counterparts to acquire parameter estimates. The third aspect of path analysis presents a means to differentiate direct, indirect, and total effects of one variable on another. The indirect effects operate through at least one intervening variable while the direct effects are those not mediated by any other variable; the total effect is the sum of direct and all indirect effects (Bollen 1989).

The synthesis of latent variables and measurement models is critical to contemporary structural equation techniques. Latent variables, as opposed to observable variables, are variables that are not directly observable but are inferred from other variables that are observed and directly measured. Other terminologies that describe latent variables are hidden variables, model parameters, hypothetical variables, or hypothetical constructs (Lexico Publishing Group, LLC, 2006). A primary advantage of employing latent variables in modeling is that latent variables decrease the dimensionality of data. In order to make it easier for individuals to understand complex data, a large number of observable variables should be aggregated to represent an underlying concept. In a way, latent variables serve the same function as general theories do in science. Simultaneously, latent variables link observable sub-symbolic data in the real world to symbolic data in the modeled world (Lexico Publishing Group, LLC, 2006).

While there are some dissimilarities between observed and latent variables, the following (Kline, Rex B., 1998) can define more specifics in the differentiation: (1) Latent variables are not necessary in the modeling – models that contain only observed

variables can be evaluated using SEM; (2) There are numerous latent variable types; each type reflects different assumptions about the relation between observed and latent variables; (3) A wide range of phenomena can be illustrated by latent variables using SEM; (4) The observed-latent distinction furthermore offers a method to account for flawed reliability of measures; this can bring about a more realistic quality to research analysis.

The factor analysis convention-initiated by Spearman (1904)-emphasized the relation of latent factors to observed variables. The central concern was focused on what is now called the measurement model. Around the 1960s and 1970s, the conceptual synthesis of models surrounding structurally related latent variables and more intricate measurement models was developed extensively in the field of sociology. It demonstrated the potential of synthesizing econometric-type models with latent rather than observed variables and psychometric-type measurement models with indicators linked to latent variables (Bollen, Kenneth A., 1989).

The final distinctiveness of structural equation models are the general estimation methods. Ad hoc estimation procedures are sometimes used to help yield parameter estimates. Browne (1982, 1984) advocated estimators that presume arbitrary distributions or elliptical distributions for the observed variables (Bollen, Kenneth A., 1989). The work of Lawley (1940), Anderson and Rubin (1956), and Jöreskog (1969) assisted in the layout for the foundation of hypothesis testing in factor analysis. Bock and Bargmann (1966) proposed an investigation of covariance structures to estimate the components of variance attributed to latent variables in multinormal observed variables. Modern

structural equation models require the use of computer software that has surfaced, such as Jöreskog and Sörbom's LISREL software and Bentler's EQS software (Bollen, Kenneth A., 1989).

SEM has a wide variety of applications that its incorporation into the research field has sought. SEM is changing the researchers' perspectives on statistical modeling and building bridges between the way social scientists and urban economists think substantively and the way they analyze and evaluate data (Bollen, Kenneth A., 1989). The fundamental overview about SEM is summarized in the following (Kline, Rex B., 1998): (1) SEM is a *priori* - researchers are obligated to deem their experimentation in terms of models; SEM applications are expressed of as a mixture of exploratory and confirmatory factor analysis; (2) SEM allows researchers to investigate an extensive array of hypotheses by creating an explicit representation of a distinction between observed and latent variables; (3) Covariance is SEM fundamental statistics; however, other types of data are possible to analyze; (4) SEM is not limited to only non-experimental (correlation) data; it has a flexibility for being an analytical tool that can be applied to data from experiments; (5) Numerous standard statistical procedures, such as multiple regression, canonical correlation, factor analysis, and ANOVA can be justified as special cases of SEM; (6) SEM is a large-sample technique; (7) SEM has the capability to test direct and indirect effects for statistical significance.

There are several reason for the deficiency in economic studies utilizing SEM. First would be that SEM has not historically been associated with or taught in the field as economists do not like to use the technique. This is obvious with an examination of

research literatures. A second reason is that economists have been educated to do analysis based on having a unit of measure/measurement – a tangible approach toward modeling. In fact, most structural equation modeling uses a concrete approach toward modeling but does incorporate the use of latent (unmeasurable) variables, where latent variables can be defined as present, probable, possible, or potential but not as evident or active. There are some economists who use structural equation modeling, but it is more preferred by sociologists and psychologists because these individuals interact with more immeasurable concepts, for example, depression, ability, or knowledge that can be expressed by employing a latent variable.

2.7 GIS Modeling Approach and Spatial Analysis

2.7.1 GIS Modeling and Analysis

Geographic Information System (GIS) is a technology about 30 years old which is primarily used for making maps (Mitchell, Andy, 1999). It has been defined as a process for looking at geographic patterns in data and at relationships between features (Mitchell, Andy, 1999). As the technology has advanced, so have the possible uses. Advanced users of today's GIS version are considered to have a strong background in mathematics and statistics so that they can use GIS to test hypotheses. GIS can be used for spatial analysis, mapping, and spatial statistical and econometric analysis.

A Geographic Information System (GIS) is an information system that is used to input, store, retrieve, manipulate, analyze and output geographically advertence data or geospatial data. Geographic information systems are created and designed on the

principal of using formal models that describe how things are located/positioned in space. A formal model is an abstract and well coordinated system of concept rudiments. It defines the terminology we use to describe and rationalize about things. Thus, geographic data models help define the terminology for describing and interpreting the matters that are located on earth (Zeiler, Michael, 1999).

With the implementation of GIS software and its analysis capabilities, the user can model data in three basic ways: as a collection of discrete features in vector format, as a grid of cells with spectral or attribute data, or as a set of triangulated points modeling a surface (Zeiler, Michael, 1999). In the study, both the vector and raster models are of a major focus.

In mathematical terms, vector data signifies features such as points, lines, and polygons. Vector data in GIS is more suited to discrete objects that specify defined shapes and boundaries. The features have a precise shape and position, attributes and metadata, and useful behavior. Raster data represents imaged or continuous data. Each cell (or pixel) in a raster is a measured quantity.

Some of the most common sources for raster datasets are satellite images, airplane surveillance photography, data converted from a triangulation, or data “rasterized” from vector data (Zeiler, Michael, 1999). In this study, the source for a raster dataset is rasterized from vector data or discrete data. Rasters are two-dimensional arrays of cells (or pixels). The height and width of each cell are fixed and the same. A raster spans a rectangular area. Each cell has a value. The value associated with a cell defines the class, group, category, or measures at the cell position (Mitchell, Andy, 1999). Cell values are

numbers: integer or floating points. Rasters that have integer valued cells can be defined with an optional attribute table, which records attributes for each unique cell value (Mitchell, Andy, 2005). One can add custom fields to the attribute table if desired. A raster can have one or many bands. The cell values of rasters can be drawn in a variety of ways, such as (i) displaying single-band rasters: monochrome image, grayscale image, and display colormap image; and (ii) displaying multiband rasters: electromagnetic spectrum (Zeiler, Michael, 1999). Raster operators can be arithmetic, Boolean, relational, bitwise, combinatorial, logical, accumulative, and assignment. There are many raster functions such as local function, focal function, zonal function, and global function. Each can accept one or many rasters as input and generate one or several rasters with the calculated results (Mitchell, Andy, 2005). There is more detailed information about the methodology behind GIS raster modeling in Chapter IV.

2.7.2 Spatial Statistics and Spatial Econometrics

"Spatial econometrics is a subfield of econometrics that deals with the treatment of spatial interactions (spatial autocorrelation) and spatial structure (spatial heterogeneity) in regression models for cross-sectional and panel data" (Anselin, Luc, 1999). The area of spatial economics is parallel to geo-statistics and spatial statistics. However, minor discrepancies do coincide in that each field is distinctive in its own array. It could be argued that spatial econometrics is distinct from spatial statistics just as econometrics is distinct from statistics in general (Anselin, Luc, 1999). When it comes to dictating the types of specifications that are of interest in spatial econometrics, this albeit subtle

distinction comes down to the central role attributed to the theoretical model rather than the data (Anselin, Luc, 1999).

Mitchell recognized some general queries that spatial statistics can answer. Statistics can describe the characteristics of a set of features such as its center (center of the features or mean, median, and central features), compactness (the cluster or dispersion of features around the center; it is measured by the standard distance deviation or weighted standard distance), and orientation and direction (measuring orientation and direction allows the abstraction of spatial trends in a distribution of a features) (Mitchell, Andy, 2005).

An individual can use this value to track changes in the distribution to compare distributions of different features. Understanding the characteristics of the data distribution helps in reaching the correct conclusions from analysis (Mitchell, Andy, 2005).

Many types of styles can form patterns. These styles can be a distribution of points, lines, or discrete areas. These patterns can be measured by overlaying areas of equivalent size, calculating the average distance between features, or tabulating a total count of the number of features within a defined distance. With the use of the statistical features allocated in GIS, one could measure any distribution of features that creates a pattern; pattern recognition for the distribution of attribute values associated with the features is also possible.

Clusters give the advantage for users to map cold or hot spots (hot spot: a county with a high value characteristic is surrounded by counties with high value characteristics;

the inverse is applied to cold spots). Cluster comparison to other location features is quite a useful process. This gives the user the advantage to comprehend why clusters happen and decide on what type of action to take. Finding individual clusters is also useful in that it allows the user to find the cause of the cluster. An individual can employ statistics, such as Geary's c and Moran's I, to identify clusters of features with similar values. Geary's c emphasizes how features differ from their immediate neighbors by comparing the values of neighboring features directly to each other. Moran's I emphasizes how features differ from the values in the study areas as whole by comparing the value of each features in pair to the mean value for all features in the study area (Mitchell, Andy, 2005).

When a determination is completed based on the features or values having an occurrence simultaneously, the strength of the relationship can be measured (Mitchell 2005). When a relationship is recognized, a prediction can be cast on where a feature or certain attribute value will transpire. A commonly used method for identifying a geographic relationship is Pearson's correlation coefficient, which is a method for variables that are interval or ratio values. Another method of choice is the Spearman rank correlation coefficient, which is used with ordinary (ranked) values. An individual can also check for spatial autocorrelation by using Moran's I or Geary's c. Linear regression is a common approach for building simple models to analyze geographic processes. (Mitchell, Andy, 2005).

Empirical validation of the new "spatial" concepts and models requires a statistical and econometric methodology that takes into account location and spatial

interaction. Spatial econometrics methods tackle issues of spatial dependence and spatial heterogeneity, as well as their extensions to the space-time domain. Like econometrics, spatial econometrics uses model specifications that are based on economic theory, with the inclusion of spatial statistics.

Anselin (1988) defines spatial econometrics as the collection of techniques that deal with the peculiarities caused by space in the statistical analysis of regional science models. Spatial econometrics investigates methodological affairs that arise from the explicit deliberation of spatial effects (spatial autocorrelation and spatial heterogeneity) (Anselin, Luc, 2000).

Anselin (1988) indicates that structural instability in the form of non-constant error variances (heteroskedasticity) or model coefficients (variable coefficients, spatial regimes) can be solved through the use of the standard econometric toolbox.

The recognition, professional development and implementation, and wide reception of the spatial systematic perception in the social sciences are considered very topical. Confirmation can be examined and even heard (i.e., conferences, lectures, and such) through numerous directions. An increasing number of journals, special issues, books, volumes, and more are dedicated to the application of mapping, GIS, or spatial analysis to subfields as diverse from criminology, epidemiology, real estate analysis, and socio-economic analysis of tropical deforestation (Anselin, Luc, 2000). This recent explosion of knowledge is often accredited to the increase of affordable GIS technology to the common desktop and the accessibility of an immeasurable array of geographically referenced socio-economic data (Anselin, Luc, 2000).

CHAPTER III

VARIABLE AND MODEL SPECIFICATIONS AND METHODOLOGY

The two most challenging issues economic researchers encounter, when trying to understand a region, are: a) determining the most relevant socioeconomic and demographic data available; and b) developing meaningful model(s) using the available information. This chapter discusses the variables and models specifications as well as the methods employed in this research. There are four specific purposes to the chapter:

1) to provide general information about the data collection and variable specifications, including definitions, measurements, sources, uses, and relevant methodologies;
2) to present the derivation of such variable estimates as are employed in the proposed models;
3) to discuss techniques and methods employed in the data analysis; and
4) to demonstrate proposed model specifications.

3.1 Data Collection and Variable Specification

The data utilized in this research comes from publicly available sources. Most of the regional analysis data for this study was produced by federal agencies, such as the U.S. Bureau of Census, U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, and private institutions – such as the Environmental Systems Research Institute (ESRI). Some of the data gathered for this study was downloaded from the Geospatial and the Statistical Center of the University of Virginia's website.

The unit of analysis is the county level. For each statistic, the following discussion includes source and conceptual framework of the data.

3.1.1 Endogenous Variables

In this research, socioeconomic development is determined by population growth from 1995 to 2000, economic growth from 1995 to 2000, and social development for 2000.

3.1.1.1 Economic Growth Variables

The economic growth factor is measured by the average annual rate of change from 1995 to 2000 in the following four variables: *PINCGRO* – Real Per Capita Personal Income, *EMPGRO* – The Total Number of People Employed, and *ESTGRO* – The Number of Establishments with Respect to the Size of Employees. Table 3.1 provides the estimation and description of each variable.

Table 3.1 Endogenous Variables Definitions for Economic Growth Factor

Variable	Variable Description	Variable Estimation
V1= PINCGRO	Average Annual Rate of Change of Real Per Capita Personal Income from 1995 to 2000	Annual rate of change of real per capita personal income is calculated by $\dot{I} = I_{it} / I_{it-1}$, where I_{it} = Personal income in place *i* at time *t* and I_{it-1} = Personal income in place *i* at time *t-1*.
V2=EMPGRO	Average Annual Rate of Change of Total Number of People Employed from 1995 to 2000	Annual rate of change of total number of people is calculated by $\dot{E} = E_{it} / E_{it-1}$, where E_{it} = Total number of people employed in place *i* at time *t* and E_{it-1} = Total number of people employed in place *i* at time *t-1*.
V3=ESTGRO	Average Annual Rate of Change of Total Number of Establishments with Respect to the Size of Employees from 1995 to 2000	Annual rate of change of total number of establishments is calculated by $\dot{Est} = Est_{it} / Est_{it-1}$, where Est_{it} = Total number of establishments with respect to the size of employees in place *i* at time *t.* Est_{it-1} = Total number of establishments with respect to the size of employees in place *i* at time *t-1*.

PINCGRO - Average Annual Rate of Change in Per Capita Personal Income: Per capita personal income measure is the total personal income of the residents of a given area divided by the resident population of the area. Personal income data comes from the Regional Economic Information System (REIS) of the U.S. Bureau of Economic Analysis (BEA). Data on per capita personal income are in nominal dollars. Nominal per capita income is converted to real per capita income using the consumer price index with a base year of 2000.

EMPGRO - Total Number of People Employed: The total number of people employed data comes from the monthly labor force estimates of the U.S. Bureau of Labor Statistics. Employment data sources can be divided into two categories: employment data by place of residence and by place of work.

ESTGRO - Number of Establishments with Respect to the Size of Employees: This data comes from County Business Pattern, U.S. Bureau of Census. The total number of establishments is classified into nine employment-size categories: 1-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250-499, 500-999, and 1000 or more.

3.1.1.2 Population Growth Variables

The population growth factor is measured by three variables: *LNDENGRO, LNIMRR*, and *LNOMRR*. *LNDENGRO* is the average annual rate of change in population density from 1995 to 2000. *LNIMRR* is the in-migration rate from 1995 to 2000. *LNOMRR* is the out-migration rate from 1995 to 2000. Table 3.2 illustrates how population growth variables are calculated.

Table 3.2 Endogenous Variables Definitions for Population Growth Factor

Variable	Variable Description	Variable Estimation
V4= LNDENGRO	Average Annual Rate of Change of Population Density 1995 to 2000	Rate of change of population density is calculated by $\dot{DEN} = DEN_{it} / DEN_{it-1}$, where DEN_{it}= Population density in place *i* and time *t* and DEN_{it-1}= Population density in place *i* and time *t-1*. Natural logarithm transformation has done for the data.
V5=LNIMRR	In-migration rate from 1995 to 2000. It is the ratio of all people who moved into the county to the average total midyear population within the Southeast region.	In-migration rate is calculated by $IMRR = IMR/POP$, where *IMR* = Number of people in-migrated, *POP* = Average annual population. Natural logarithm transformation has done for the data.
V6=LNOMRR	Out-migration rate from 1995 to 2000. It is the ratio of all people who leave a particular county to the average total midyear population within the Southeast region.	Out-migration rate is calculated by $OMRR = OMR/POP$, where *OMR* = Number of people out-migrated and *POP* = Average total midyear population. Natural logarithm transformation has done for the data.

LNDENGRO – Average Annual Rate of Change in Population Density from 1995 to 2000: The population density is the number of people per unit of area of county. Population data is from the Population Estimates Program, U.S. Bureau of Census. The area data is from the GIS database from ESRI. The population estimate is the calculated number of individuals living in an area as of July 1 of each year (U.S. Census Bureau, 1990). The estimated population from 1995 to 2000 was calculated from a component of

change model that integrates information on natural change (births, deaths) and net migration (net internal migration, net international migration) that has taken place in an area since a 1990 Census reference date (U.S. Census Bureau, 1990). Area is the size in square kilometers recorded for each geographic entity.

LNIMRR - In-migration Rate from 1995 to 2000 and *LNOMRR* - Out-migration Rate from 1995 to 2000: Migration data comes from the 2000 Decennial Census Data of Population and Housing, which was conducted by the U.S. Bureau of Census. The number of migrants who moved to that county from another county is listed in inflow files for each county in each state (U.S. Census Bureau, 2000). The number of migrants who moved away from that county to another county is listed in outflow files for each county in the state (U.S. Census Bureau, 2000). "The migration file contains Federal Information Processing Standard (FIPS) county codes of previous residence (in 1995) and current residence (in 2000), as well as the number of migrants who moved between those two counties (in- and out-flow)" (U.S. Census Bureau, 2000).

3.1.1.3 Social Development Variables

The social development factor for 2000 is measured by the variables of *EDUC_00* – Education Dimension Index for 2000, *ECON_00* – Economic Opportunity Dimension Index for 2000, and *HOUS_00* – Housing Dimension Index for 2000. These indices are calculated by Estrada's method (Estrada, Joselito K., 2005) for the human development index (HDI) for a county, which is based on the United Nations Development Program (UNDP) method (United Nations Development Programme, 2001). Table 3.3 shows how the indexes for the socioeconomic development are calculated for each county. An

example is shown in Table 3.3. A series of dimension/indicator indexes is be developed to show progress vis-à-vis other counties in the same state. These indexes were calculated below.

- *V7= Education Dimension Index = $(X^{E1} + X^{E2} + X^{E3}) / 3$, where*
  - *X^{E1} Index = $(X^{E1}_i - \min X^{E1}) / (\max X^{E1} - \min X^{E1})$*
  - *X^{E2} Index = $(X^{E2}_i - \min X^{E2}) / (\max X^{E2} - \min X^{E2})$* *(3.1)*
  - *X^{E3} Index = $(X^{E3}_i - \min X^{E3}) / (\max X^{E3} - \min X^{E3})$*

- *V8=Economic Opportunity Index = $(Y^{E1} + Y^{E2} + Y^{E3}) / 3$, where*
  - *Y^{E1} Index = $(Y^{E1}_i - \min Y^{E1}) / (\max Y^{E1} - \min Y^{E1})$*
  - *Y^{E2} Index = $1 - [(Y^{E2}_i - \min Y^{E2}) / (\max Y^{E2} - \min Y^{E2})]$* *(3.2)*
  - *Y^{E3} Index = $1 - [(Y^{E3}_i - \min Y^{E3}) / (\max Y^{E3} - \min Y^{E3})]$*

- *V9=Housing Dimension Index = $(Z^{H1} + Z^{H2} + Z^{H3}) / 3$, where*
  - *Z^{H1} Index = $(Z^{H1}_i - \min Z^{H1}) / (\max Z^{H1} - \min Z^{H1})$*
  - *Z^{H2} Index = $(Z^{H2}_i - \min Z^{H2}) / (\max Z^{H2} - \min Z^{H2})$* *(3.3)*
  - *Z^{H3} Index = $(Z^{H3}_i - \min Z^{H3}) / (\max Z^{H3} - \min Z^{H3})$*

Overall Well-Being Index or Human Development Index =
(Education Index + Employment Opportunity Index + Housing Index) / 3 *(3.4)*

Table 3.3 2000 Socioeconomic Indicators for Oktibbeha County, MS

Indicators	Variable	
	Name	**Value**
Education Dimension Indicators		
Percent of persons aged 25 and older who are high school graduates	X^{E1}	80 %
Percent of persons aged 25 and older who are college graduates	X^{E2}	34.8 %
Percent of total population that are enrolled in elementary and high school	X^{E3}	15.5 %
Economic Opportunity Dimension Indicators		
1999 Median household income	Y^{E1}	$24,899
Percent of families living below the poverty level in 1999	Y^{E2}	17.99 %
Average monthly unemployment rate	Y^{E3}	5.3%
Housing Dimension Indicators		
Total number of housing units	Z^{H1}	17,344
Number of owner-occupied housing units	Z^{H2}	8,872
Median value of owner-occupied housing units	Z^{H3}	$89,400

Note: Estrada & Allen (2004) Table Layout

The min (max) value for each variable represents values for counties in the state with the lowest (highest) value for the variable under consideration.

The quality of life includes how well people live in terms of their housing, family importance, health status, and public safety. It is believed that money cannot buy everything, and the quality of life comes into effect when trying to analyze such a statement. In this central study, the quality of life measured was noted by how well people lived in terms of housing.

Z^{E1}- Total Number of Housing Units, Z^{E2} – Number of Owner-occupied Housing Units, and Z^{E3} – Median Value of Owner-occupied Housing Units: "*HOUS_90*" and "*HOUS_00*" are calculated based on the above 3 variables. Data came from the 1990 and

2000 Census of Population and Housing. Data obtained and utilized is downloaded from the County and City Data Books, 4th Edition, at the Geospatial and Statistical Data Center - University of Virginia website (U.S. Census Bureau, 2005). The following provides more detail in terms of housing from the U.S. Census Bureau, 2000.

X^{E1}- Percent of Persons Aged 25 and Older Who Were High School Graduates, X^{E2}- Percent of Persons Aged 25 and Older Who Were College Graduates, and X^{E3} - Percent of Total Population That Were Enrolled in Elementary and High School: The education dimensions indexes, *EDUC_90* and *EDUC_00,* are calculated based on the educational attainment data. Data came from the 1990 Decennial Census of Population and Housing: U.S. Bureau of Census. Data obtained was downloaded from the County and City Data Books, 4th Edition, at the Geospatial and Statistical Data Center - University of Virginia website.

Y^{E1}- 1989 and 1999 Median Household Income: The 1990 and 2000 Decennial Censuses of Population and Housing: U.S. Bureau of Census. Data obtained and used was downloaded from the County and City Data Books, 4th Edition, at the Geospatial and Statistical Data Center - University of Virginia website.

Y^{E2}- Percent of Families Living Below the Poverty Level in 1989 and 1999: *Source:* 1990 and 2000 Decennial Censuses of Population and Housing: U.S. Bureau of Census. Data obtained and employed was downloaded from the County and City Data Books, 4th Edition, at the Geospatial and Statistical Data Center - University of Virginia website.

Y^{E3} – Average Monthly Unemployment Rate for 1990 and 2000: Data comes from Local Area Unemployment Statistics Program, U.S. Bureau of Labor Statistics.

3.1.2 Exogenous Variables

All exogenous variables could be classified into the following four major groups:

Demographic characteristics: *NATINC* - Average Annual Rate of Change of Natural Increase from 1995 to 2000, *MEDAGE* - Median Age for 1995, and *LNRACE* - Ratio of Percentage of Black and Other Race Population to Percentage of White Population for 1995;

Social Development Level 1990: Human Development Index (HDI) for 1990, which was determined by *EDUC_90* – 1990 Education Dimension Index, *ECON_90* – 1990 Economic Opportunity Dimension Index, and *HOUS_90* – 1990 Housing Dimension Index;

Urban Transition Characteristics: *LNGRAV* - Average Gravitation into the Large Cities, and *RUC* – Dummy Variables for Rural Urban Continuum; and

Environmental Characteristic: *COAST* - Dummy Variables for Coastal Counties.

Table 3.4 provides the description of all exogenous variables, how these variables were estimated, and what type of transformation was made (if data was needed to transform in order to apply for the normality theory). A few detailed explanations for some variables estimation are provided below.

Table 3.4 Exogenous Variables Definitions

Variable	Variable Description	Variable Estimation
V10=MEDAGE	Median Age for 1995	
V11= LNNATINC	Average of Ratio of number of births to number of deaths from 1995 to 2000	$LNNATINC = LN(Birth/Death)$. Natural logarithm transformation has done for the data
V12=LNRACE	Ratio of Percentage of Nonwhite Population to Percentage of White Population for 1995	$LNRACE = LN((BlACK95 + OTHER95)/WHITE9$ Natural logarithm transformation has done for the data.
V13= ECON_90	Economic Opportunity Index for 1990	See explanation for *ECON_00*
V14=EDUC_90	Education Dimension Index for 1990	See explanation for *EDUC_00*
V15=HOUS_90	Housing Dimension Index for 1990	See explanation for *HOUS_00*
V16=LNGRAV	Average Gravitation into the Large Cities	$GRAVITY = \frac{POP_i \cdot POP_j}{d^2}$, where POP_i is the total number of population for each county in 1995, POP_j is the total number of population for each large city in 1995, and d is the distance between a large city and a county center.
RUC	Rural Urban Continuum Code	Using rural and urban continuum code.
COAST	Dummy Variable for Coast	1 - Coastal county 0 - Non-coastal county

3.1.2.1 Demographic Variables

NATINC – Average of the Ratio of the Number of Births to Number of Deaths from 1995 to 2000: Population data was obtained from the Population Estimates Program, U.S. Bureau of Census. One set of data is given as the total number of births occurring to residents of the United States as estimated by the Census Bureau using data from the National Center for Health Statistics (U.S. Census Bureau, 2001). Another set

of data is given as the total number of deaths occurring to residents of the United States as estimated by the Census Bureau using data from the National Center for Health Statistics (U.S. Census Bureau, 2001).

MEDAGE - Median Age for 1995: Median age is rounded to the nearest tenth in this study (U.S. Census Bureau, 2001). Data comes from the population estimates program of the U.S. Bureau of Census. The age classification is based on the age of the person in complete years as of April 1, 2000 (U.S. Census Bureau, 2006).

LNRACE – Ratio of Percentage of Nonwhite Population to the Percentage of White Population (*WHITE95* – Percentage of White Population - 1995, *BLACK95*- Percentage of Black Population - 1995, *OTHER95* – Percentage of Other Population – 1995): This data comes from the Population Estimates Program of the U.S. Bureau of Census. The Census Bureau conception of race reflects self-identification by individuals according to the race or races with which they most closely identify (U.S. Census Bureau, 2001). In this research, data on population by race group was divided into two categories, which were white and nonwhites.

3.1.2.2 Social Development Level for 1990

Information on variable specification of the social development level for 1990 was already available at the social development 2000 section.

3.1.2.3 Urban Transition Characteristics

LNGRAV - Average Gravitation into the Large Cities: According to the U.S. Bureau of Census City Classification, the term “large city” refers to incorporated places

with a 1990 population of 100,000 or more. By 1990 population, the Southeast had 34 large cities: Alabama: Birmingham, Huntsville, Mobile, and Montgomery; Arkansas: Little Rock; Florida: Fort Lauderdale, Hialeah, Hollywood, Jacksonville, Miami, Orlando, St. Petersburg, Tallahassee, and Tampa; Georgia: Atlanta, Columbus, Macon, and Savannah; Kentucky: Lexington-Fayette and Louisville; Louisiana: Baton Rouge, Metairie, New Orleans, and Shreveport; Mississippi: Jackson; North Carolina: Charlotte, Durham, Greensboro, Raleigh, and Winston-Salem; Tennessee: Chattanooga, Knoxville, Memphis, and Nashville-Davidson (U.S. Census Bureau, 1995). It is possible that in urban areas, there are many relevant factors of differential advantages between urban and country that could be quantified, perhaps based on many job opportunities, higher salary, more entertainment, better education, etc. Although people are attracted to move towards a large city because of conceived better opportunities, the distance factor can be assigned as a restriction. Within a country, distance is possibly the most apparently significant characteristic of the migration journey, and nearly all analyses of migration flows have evaluated the extent to which migration streams attenuate with longer distance (Hoover, Edgar M. and Frank Giarratani, 1999). The distance from each county center to each large city was calculated in the ArcMap. Some previous empirical findings demonstrated that, even when the direct expenses involved in relocating were easily recovered with a higher salary, migration did not take place.

Distance serves not only as a proxy for transportation costs but also for psychic costs and information costs (Lansing and Mueller, 1967, Schwartz, 1973); sometimes this is referred to as a "*social* distance." There may be a degree of difficulty for the migrant in having to make adequate social adjustment after he or she arrives to their specific

destination. "Gravity-type," where migration occurs, is directly related to the size of the origin and destination populations and inversely related to the distance square (Greenwood, 1975). In this research, "gravity" from a county to a large city is defined to be directly proportional to the population of a county and a large city and inversely proportional to the square of the distance from a county to a large city.

RUC – Dummy Variables for Rural Urban Continuum: Models are estimated for metro counties, urban counties, rural counties, and counties that had less than 20, 000 population. The dataset is classified into the following nine categories based on the rural and urban continuum code. The following provides an overview on the Rural-Urban Continuum Codes defined by the U.S. Department of Agriculture, 2006.

Table 3.5 Rural and Urban Continuum Code Classification

Code	Description
Metro Counties	
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
Non-metro Counties	
4	Urban population of 20, 000 or more, adjacent to a metro area
5	Urban population of 20, 000 or more, not adjacent to a metro area
6	Urban population of 2, 500 to 19,999, adjacent to a metro area
7	Urban population of 2, 500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Source: Measuring Rural and Urban Continuum Code (U.S. Department of Agriculture, 2006).

3.1.2.4 Environmental Variable

COAST- Dummy Variables for Coastal Counties: The attached list (Appendix 3.A) contains all counties of the Southeast defined as *coastal* by the Strategic Environmental Assessments Division of the National Oceanic and Atmospheric Administration (NOAA). There are 206 coastal counties in the Southeast (105 counties in the Atlantic, 101 counties in the Gulf of Mexico), which was 31% of all coastal counties.

3.2 Analytical Framework

Three most important and basic questions of the research goals in this study were: where, what, and why economic activity takes place.

Where? Maps, generally, present the fastest answer to the question of where. The logical basic method to obtain an answer is to study a map with careful analysis. Therefore, all data are visualized using GIS mapping techniques.

What? This question deals with the description statistics as well as with numbers. For instance, what is the population in the Southeast? How many establishments are in the Southeast? Therefore, descriptive statistics analysis are examined which produce a summary and overview of the dataset.

Why? The answer to this question involves obtaining significant results from the data analysis and modeling analysis, which explain the relationship between economic growth and population growth toward the social development over space, and how this

relationship is different in the context of rural and urban differences and coastal and non-coastal differences.

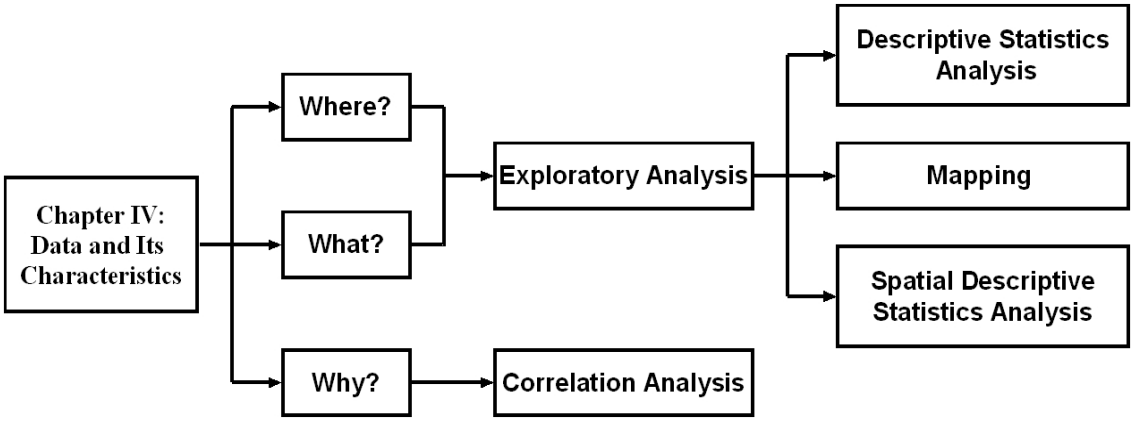


Figure 3.1 Analytical Framework of the Chapter IV

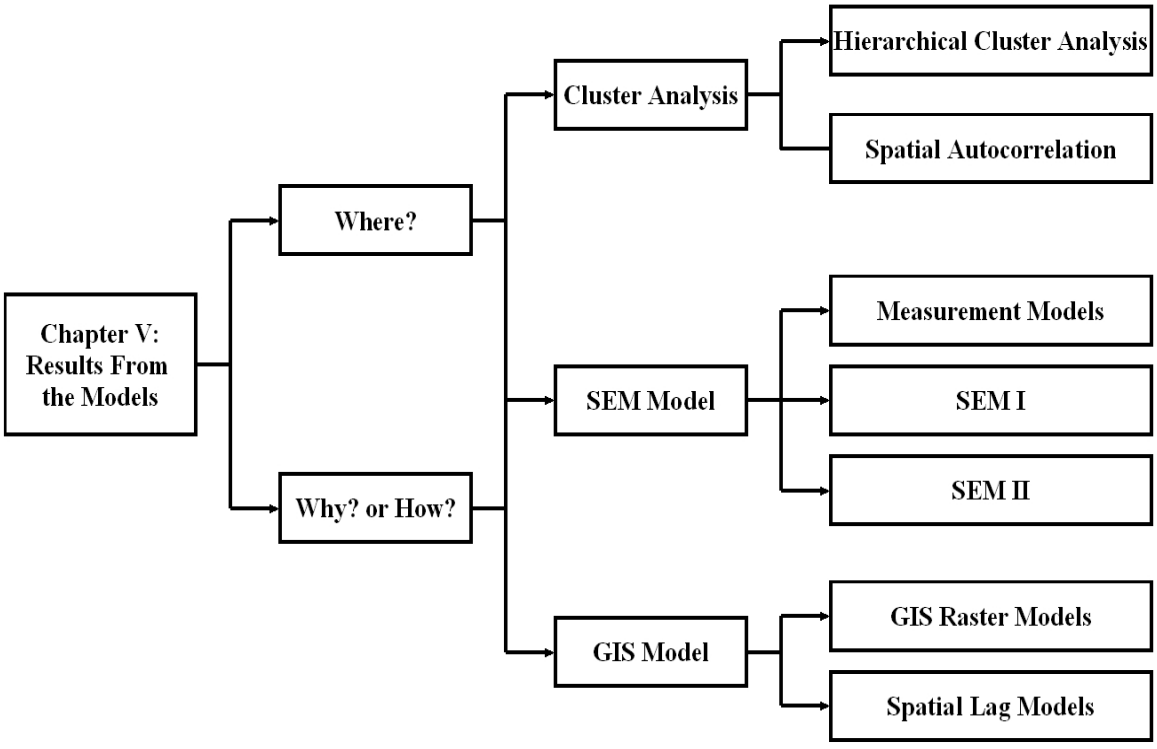


Figure 3.2 Analytical Framework of the Chapter V

The framework of the empirical analysis of this research is presented in Figure 3.1 and 3.2. Descriptive statistics, mapping, spatial descriptive statistics, and the correlation between variables are provided in Chapter IV. Results of the cluster analysis (hierarchical cluster analysis, spatial autocorrelation analysis (spatial cluster analysis, hot and cold spot analysis)), structural equation models including measurement models, GIS models, and spatial econometrics analyses are demonstrated in Chapter V.

3.3 Methods and Techniques Employed in Chapter IV

3.3.1 Descriptive Statistics Analysis

The basic features of the data are described by descriptive statistics or summary statistics, which are mean, mode, median, standard deviation, variance, range, skewness, and kurtosis. There are three objectives in obtaining the summary statistics in this research.

The first objective is to measure the central tendency or central location of the variable. The mean, which is the arithmetic average, measures the central tendency of the variable. A measure of the central tendency or central location is necessary, but not sufficient in the summary of the characteristics of the dataset.

Therefore, the second objective is to measure the dispersion of the variable. The standard deviation and range (informing minimum and maximum value) are used to measure the statistical variability or dispersion of variable. Discrepancies from the mean, average of squared discrepancies (variance), square root of the variance (standard

deviation), and the difference between the largest and the smallest observation (range) are also examined.

The third objective is to measure the shape of the data distribution. A significant feature of the variable description is the shape of its distribution. This provides the number of observations in each class (frequency). Naturally, a researcher is interested in how well the distribution can be approximated by the normal distribution. Skewness and kurtosis can provide information about the shape of the data distribution. If the distribution is normal, then distribution is perfectly symmetric (the skewness is zero or close).

Another important step for this data analysis is to define outliers. By definition, outliers are a typical infrequent observation. Outliers, or even a single outlier, can have a profound/capable influence on the slope of the regression line and consequently, on the value of the correlation coefficient. The outliers are excluded from the cluster data analysis.

Finally, different types of cross-tabulation are provided in the descriptive statistic analysis along with maps and spatial descriptive statistics.

3.3.2 GIS Mapping

Maps are basic tools and essential to understanding spatial relationships which involve questions of proximity, concentration, dispersion, and similarity or disparity of spatial patterns or distribution. Maps can be discussed in broad terms of regions, or micro-geographically in terms of belts, zones, lands, neighborhoods, and/or sites. All data in this analysis are visualized using GIS mapping techniques. The maps help

disclose the location of economic activity and/or population concentrations in regions and places of population and/or economic activity avoided. Another beneficial factor is that that it helps disclose locations that exist between the two extremes of population and economic activity.

All maps created in Chapter IV are summarized by area. All variables are visualized in a point file or polygon file. The following steps were taken in order to create maps in Chapter IV.

Step 1: Layers were created. When assembling data (sets), there were two types:

- spatial data (GIS database), which has already defined the same map projection and coordinate systems (data for areas for county and state, location of universities, interstate highways, and location for large cities and capitals of state)
- Numeric data does not have any spatial information given. Therefore, all the numerical data was converted and assigned to an area (polygon).

Step 2: Layers were projected. These layers were required to define the projection and coordinate system. A map projection transforms the position on the globe (which is almost spherical) onto a flat surface (Mitchell, Andy, 1999). All layers should be in the same map projection and coordinate system - so all layers need to be re-projected again. All layers are projected and/or re-projected by the North American Datum of 1983 (NAD, 1983). This is the fundamental format architecture employed to project a map (spherical) onto a flat surface form. There are a few more significant steps, other than map projection and coordinate systems, to generate a map. The other steps are to understand the geographic features of the data, comprehend how the data can be analyzed, and decide how to represent the data in GIS.

Step 3: Classification of Layers. To organize and make sense of the data is vital. Similar values were grouped into the same class in order to make the distinction between classes as great as possible. There are four primary types of standard classification schemes. These are natural breaks, quantile, equal intervals, and standard deviations. In this research, the natural breaks classification scheme was used, in which GIS determined the high and low value for each class using a mathematical procedure testing different class breaks. The GIS software program chose the class breaks that best group similar values and maximizes the differences between classes (Mitchell, Andy, 1999).

Step 4: Creation of Maps. After the decision of the data classification, the type of maps to be created is determined. Any of the following options can be chosen from the GIS software: graduated symbols, graduated colors, charts, contours, and 3-D perspective views. Selections of the types are based on the type of data and the type of representation. The ColorBrewer™ web tool was used to create attractive graduated color scheme.

3.3.3 Spatial Descriptive Statistics Analysis

Spatial statistics can describe the characteristics of a set of features, such as its center (center of the features or mean, median, and central features), compactness (the cluster or dispersion of features around the center), and orientation and direction (measuring orientation and direction allows the abstraction of spatial trends in a distribution of a features) (Mitchell, Andy, 2005).

1) Measuring center: The central feature represents the most centrally located feature in terms of distance; it is ideal for finding the most accessible feature (the feature

that is the shortest total distance from all the other features) (Mitchell, Andy, 2005). The central feature was calculated in this study.

2) Measuring compactness: The measure of compactness is a solitary value representing the dispersion of features around the center. The value is a distance, represented on a map by drawing a circle with the radius equal to the value. To calculate the compactness of a distribution, GIS measures the average distance the features vary from the mean center. The standard distance was calculated by formula 3-5 (Mitchell, Andy, 2005).

$$SD = \sqrt{\frac{\sum_i (X_i - \overline{X})^2}{n} + \frac{\sum_i (Y_i - \overline{Y})^2}{n}} \qquad (3-5)$$

3) Measuring orientation and direction: The assumption for measuring orientation and direction is that there are spatial trends in a distribution of features. Although the result is very similar to standard distance circle, it is displayed as an ellipse showing the orientation of the distribution (Mitchell, Andy, 2005). Calculating the ellipse gives a more accurate picture than using the standard distance circle because it displays the orientation of the distribution. The standard deviational ellipse is calculated in this research. The standard deviational ellipse is calculated by equations (3-6) and (3-7) (Mitchell, Andy, 2005).

$$SD_X = \sqrt{\frac{\sum_i (X_i - \overline{X})^2}{n}} \qquad (3-6)$$

$$SD_Y = \sqrt{\frac{\sum_i (Y_i - \overline{Y})^2}{n}} \qquad (3-7)$$

When employing the use of these spatial descriptive statistics, it is possible to track changes in the distribution to compare distributions of different features. It is also important to comprehend the characteristics of the data distribution, which helps to make the correct or more reliable conclusions from the analysis (Mitchell, Andy, 2005).

3.3.4 Correlation Analysis

The Simple Linear Correlation (Pearson ρ) is calculated for the relationship or association between the variables. The Simple Linear Correlation (Pearson ρ), assumes that the two variables are measured on at least interval scales, and it determines the extent to which values of the two variables are "proportional" to each other (Newbold, Paul 1995). Proportional means linearly related. Let X and Y be a pair of random variables, with means μ_X and μ_Y and variances σ_X^2 and σ_Y^2. A measure of the strength of their linear association is provided by the correlation coefficient, ρ, defined as

$$\rho = Corr(X,Y) = \frac{Cov(X,Y)}{\sigma_X \cdot \sigma_Y} = \frac{E[(X-\mu_X)\cdot(Y-\mu_Y)]}{\sqrt{E[(X-\mu_X)^2]\cdot E[(Y-\mu_Y)^2]}} \qquad (3-8)$$

The value of the correlation (correlation coefficients) must lie between -1.00 and +1.00. The value of -1.00 implies a perfect negative linear association or correlation while a value of +1.00 implies a perfect positive linear association or correlation. A value of 0.00 represents no linear association (no correlation) or a lack of correlation. The larger the absolute value of the correlation, the stronger the linear association between the variables. The regression line lays either straight upward sloping or downward sloping. The correlation coefficient (i.e. the value of correlation) does not depend on the specific measurement units used.

The significance level calculated for each correlation is a primary source of information about the reliability of the correlation. The significance of a correlation coefficient and its magnitude depends on the size of the sample from which it was computed. Another factor of the correlation coefficient is a lack of homogeneity in the sample from which a correlation was calculated. If any such occurrence of heterogeneity on the correlations is found and if subsets of the data can be found to be homogeneous, then, correlations can be calculated separately in each subset of observations. If homogeneous subsets cannot be determined, the data are usually examined by some exploratory multivariate techniques, for instance, cluster analysis.

3.4 Methods and Techniques Employed in Chapter V

3.4.1 Cluster Analysis

Cluster analysis allows the determination of a system of organizing observations the identification of groups of observations that are similar to one other but different from individuals in other groups. Cluster analysis is an exploratory data analysis tool which can be used to sort different objects into groups in which the degree of association between two objects is maximum if they belong to the same group and minimum otherwise. There are several methods in statistics to sort dataset into groups. These methods include hierarchical cluster analysis, k-means cluster (also known as Quick Cluster), and two-step cluster. The methodical choice is dependant on the size of data (Everitt, Brian S., Sabine Landau and Morven Leese, 2001). If a dataset has 1000 or more cases, the two-step procedure is normally employed (Everitt, Brian S., Sabine

Landau and Morven Leese, 2001, Lexico Publishing Group, LLC, 2006, SPSS, 2007). If a dataset has small cases and solutions with increasing numbers of clusters are needed, then the hierarchical clustering procedure is more appropriate to utilize (Everitt, Brian S., Sabine Landau and Morven Leese, 2001, SPSS, 2007). If the number of desired clusters is known and the dataset is at least moderate in size, then k-means clustering would be best suited for the task (Everitt, Brian S., Sabine Landau and Morven Leese, 2001, SPSS, 2007).

3.4.1.1 Hierarchical Clustering

The hierarchical clustering method is one of the most straightforward cluster methods. Decisions on what variables to collect and include in the analysis is very important because the selection of irrelevant measures will not aid in classification. A common approach to doing a cluster analysis is to first build a table of relative similarities or differences between all objects, and secondly, employ this information to combine the objects into groups. Hierarchical clustering analysis in this study was performed using the software SPSS. The final dendrograms results are demonstrated in Chapter 5. The dendrogram is a tree diagram showing how subgroups are joined to become clusters. In order to create the dendrogram, the following steps were applied in the utilization of SPSS.

Step1: A table of relative similarities is called the proximities matrix. While a correlation matrix shows the correlation or degree of similarity between variables, a proximities matrix contains similarities between observations. The proximities matrix entries are the absolute values of the difference between two scores, and are called the

distance (similarities) (Stockburger, David W., 2006). These distances, or similarities, can be contingent on a solitary dimension or several dimensions, with each dimension representing a rule or condition for grouping objects. Univariate cluster analysis groups are contingent on a solitary measure, while multivariate cluster analysis is contingent on multiple measures (StatSoft, Inc., 1984-2004, Stockburger, David W., 2006). In this research, multivariate cluster analysis was employed for each factor construct. SPSS provides numerous possible measures of distance. For this study, employment of the Euclidean distance method is used to measures distance, since the Euclidian distance method is the most straightforward way of computing distance between objects in a multi-dimensional space. Written in equation form, Euclidian distance is the geometric distance in the multidimensional space that is computed as the following (Hair Jr, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1987, StatSoft, Inc., 1984-2004):

$$Distance(x, y) = \{\sum_i (x_i - y_i)^2\}^{1/2} \qquad (3\text{-}9)$$

In general, Euclidean and squared Euclidean distances are typically computed from raw data and not from standardized data. (StatSoft, Inc., 1984-2004) Euclidean distance method has some specific advantages. The distance between any two objects is not affected by the addition of new objects in the analysis, which reduced the problem of outliers. However, differences in the scale among the dimensions from which the distances are computed can affect the distances (Hair Jr, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1987, Norusis, Marija, 2005-2007, StatSoft, Inc., 1984-2004).

Step 2: Once the calculation of the distance between objects is executed, the next process is to separate the objects into groups based on distances (Stockburger, David W., 2006). The hierarchical clustering method does not require a priori knowledge of the

number of groups (Hair Jr, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1987, Norusis, Marija, 2005-2007, Stockburger, David W., 2006). There are two general methods of hierarchical clustering methods. They can either be agglomerative or divisive. Agglomerative hierarchical clustering begins with every case being a subgroup or cluster, and then combines like subgroups into more inclusive subgroups until only one group remains. Divisive clustering starts with everything in one cluster or a single group, which is then partitioned into subgroups and then further partitioned into subgroups that end up with everyone in individual clusters. In either case, the results of the application of the clustering technique are best described using the dendrogram binary tree (Hair Jr, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1987, Norusis, Marija, 2005-2007, StatSoft, Inc., 1984-2004, Stockburger, David W., 2006). In this study, agglomerative hierarchical clustering is employed.

Step 3: Once several objects have been coupled or linked, the distance needs to be determined between those new clusters, and a linkage or amalgamation rule is needed to establish when two clusters are sufficiently similar to be linked together (StatSoft, Inc., 1984-2004). In this study, the distance between two subgroups is computed by using single linkage or the nearest neighbor method, which is the distance between two subgroups as the minimum distance between any two members of opposite groups. The distance between two clusters is determined by the distance of the two closest objects (nearest neighbors) in the different clusters. This rule will, in a sense, string objects together to form clusters, and the resulting clusters tend to represent long chains (StatSoft, Inc., 1984-2004) Finally, single linkage dendrogram of the data is generated. The interpretation of a dendrogram is fairly straightforward. The objects are

characterized as nodes in the dendrogram, and the branches exemplify when the cluster method joins subgroups containing that object (Hair Jr, Joseph F., Rolph E. Anderson and Ronald L. Tatham, 1987).

3.4.1.2 Spatial Autocorrelation Analysis

Spatial Autocorrelation Analysis is performed here using GeoDa 0.95-i software. Spatial autocorrelation is defined as an assessment of the spatial pattern of correlation of a variable (Mazinga, Gideon, 2006). Spatial autocorrelation exists if the values are interrelated and if there is a spatial pattern to the correlation. Spatial autocorrelation measures the level of interdependence between the variables (Childs, Colin, 2004). Moreover, it can be defined as the nature and strength of the interdependence (Childs, Colin, 2004, Mazinga, Gideon, 2006). Positive spatial autocorrelation usually exists in geographic applications, whereas negative spatial autocorrelation occurs as a sensitivity to changes in scale.

Spatial autocorrelation shows patterns that might illustrate an underlying process, describe a spatial pattern and employ as verification support. The verification support can be employed as a diagnostic tool for the nature of residuals in a regression analysis, as an inferential statistic to buttress assumptions about the data, and as a data interpolation technique (Wulder, Mike, 2005).

The following are the steps to Compute Spatial Autocorrelation:

1) Creation of Spatial Weights: The weight matrix, which represents the relationships between cases, is created using the Rook contiguity case (neighbors determined on four directions). Rook contiguity uses only common boundaries to define

neighbors. Because the shape file is a projected map, the Euclidean Distance method was employed for the type of distance metric (the variable holding x-coordinate and the variable holding y-coordinate with x-centroids and y-centroids) (Anselin, Luc, 2003a, b).

2) Examination of Spatial Weight Characteristics: After constructing the weight matrix, spatial weight characteristics are examined. This allows a connectivity histogram to be generated, as well as the illustration of the quantity of observations by the number of neighbors.

3) Construction of Spatially Lagged Variables: A spatially lagged variable is a sum of spatial weights multiplied by the values of observations at neighboring locations (Anselin, Luc, 2003b).

4) Creation of Moran Scatter Plot: Computation of Moran's I is attained by division of the spatial covariation by the total variation (Laymon, Charles, Paul J. Meyer and Steven J. Goodman, 2005). Resultant values range from approximately -1 to 1. The positive values indicate positive spatial autocorrelation, while the opposite is true for negative values. If there is a zero result, this indicates the lack of spatial autocorrelation (Anselin, Luc, 2003a, b, Wulder, Mike, 2005). Moran's I spatial autocorrelation statistics can be envisioned as the slope in a scatter plot with the vertical axis having the spatially lagged variable and the horizontal axis having the original variable (Anselin, Luc, 1988, 1999a, b, 2003a, b). The variables are standardized to assist in the interpretation and categorization of the spatial autocorrelation (cluster or outlier), while the slope of the regression line is defined to be the Moran's I statistics (Anselin, Luc, 1988, 2003a, b). In the scatter plot, the four quadrants correspond to dissimilar types of spatial correlation; they are the spatial clusters in the upper right (high- high or hot spot), lower left (low-low

or cold spot) and spatial outliers in the lower right (high – low) and upper left (low-high) quadrants (Anselin, Luc, 2003b).

5) Creation of LISA Maps: The local measures of the spatial autocorrelation are implemented as LISA maps. The results of spatial autocorrelation can be shown in four types of maps: the significance map, the cluster map, the box plot, and the Moran scatter plot (Anselin, Luc, 2003b). The cluster map shows the clusters and outliers location with a significant Local Moran. In this research, cluster maps are provided.

3.4.2 Structural Equation Modeling

3.4.2.1 Simple Factor Analysis Models/ Measurement Models

The following three measurement models are examples of the Spearman's common factor model. The latent independent variables are F_1 (economic growth factor from 1995 to 2000), F_2 (population growth factor from 1995 to 2000), and F_3 (2000 social development factor) they are the single common factors for each construct. *PINCGRO, EMPGRO, ESTGRO*, *LNDENGRO, LNIMRR*, *LNOMRR, EDUC_00, ECON_00* and *HOUSE_00* are referred to as the dependent variables (*Y*s). The random deviations or residuals (E_1, E_2, E_3, E_4, E_5, E_6, E_7, and E_8) are specific factors. The regression coefficients (α_{11}, α_{12}, α_{13}, α_{14}, β_{21}, β_{22}, β_{23}, γ_{31}, γ_{32}, and γ_{33}) are factor loadings. In the above path diagrams, observed variables (*Y*s) are enclosed in square boxes, and causal links are represented by single headed arrows. Unobserved variables or latent variables or factors, *F1*, *F2* and *F3,* are enclosed in the circle. The measurement errors, *E*s, are not enclosed by a box. The assumption is that *Y*s and *E*s are uncorrelated. It is

also assumed that the *E*s have a mean of zero and constant variance, *Var(E)*. The error variances are known as specific variances and the ratio, $\alpha_{11}^2 \cdot Var(E_1)/Var(V_1)$. In this particular example of Spearman's factor analysis model, the communality of a particular measure can be interpreted as its reliability.

A model is identified if it is theoretically feasible to calculate a unique estimate of every one of its parameters. If not, then the model is marked as not identified. There has to be at least as many observations as there are model parameters. Models that violate this requirement are not identified (Kline, Rex B., 1998). The just-identified model has no degrees of freedom and, therefore, can never be rejected. An over-identified model is one with the number of estimable parameter being less than the number of data points. This results in positive degrees of freedom that permit for the rejection of the model, thereby rendering it useful for hypothesis testing (Dunn, G., B. Everitt and A. Pickles, 1993). So, there is a need to obtain an over-identified estimated factor analysis model(s).

The Economic Growth Measurement Model

The economic growth measurements are the average rate of change in real per capita personal income (*PINCGRO* or V_1), the total number of people employed (*EMPGRO* or V_2), and the number of establishments (*ESTGRO* or V_3) from 1995 to 2000. The measurement model for the economic growth from 1995 to 2000 is

$$\begin{aligned} PINCOME &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\ EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\ ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3 \end{aligned} \tag{3-10}$$

This is illustrated by the path diagram in Figure 3.3.

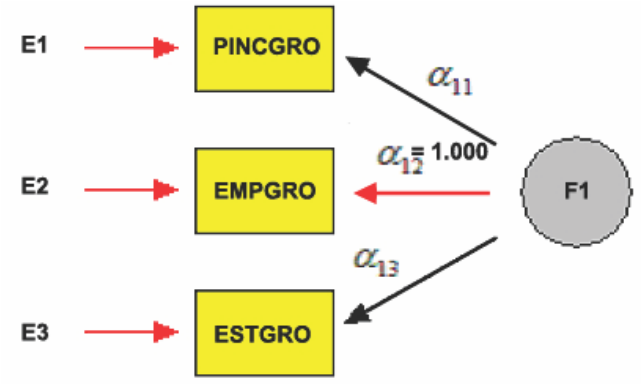


Figure 3.3 Path Diagram for a Factor Analysis Model of the Economic Growth

Ignoring the mean and intercept parameters, there are seven parameters that need to be estimated from the data: the regression coefficients (α_{11}, $\alpha_{12,}$ and α_{13}) and the variances ($Var(F_1)$, $Var(E_1)$, $Var(E_2)$, and $Var(E_3)$). The six statistics available for use in the parameter estimations are $Var(V_1)$, $Var(V_2)$, $Var(V_3)$, $Cov(V_1,V_2)$, $Cov(V_1,V_3)$, and $Cov(V_2,V_3)$. In order to estimate the model, if either $Var(F_1)$ is constrained to be 1 or one of the regression coefficients is constrained to be 1, then the model would be over-identified. For the factor analysis model of the economic growth measurements, the total number of people employed (*EMPGRO* or V_2) is constrained to be 1 (α_{12}=1).

The Population Growth Measurement Model

The population growth is measured by three variables, which are the average annual rate of change in population density from 1995 to 2000 *(LNDENGRO* or V_4), in-migration rate from 1995 to 2000 (*LNIMRR* or V_5), and out-migration rate from 1995 to 2000 (*LNOMRR* or V_6). The measurement model for the population growth from 1995 to 2000 is

$$
\begin{aligned}
LNDENGRO = V_4 &= \beta_{01} + \beta_{21} \cdot F_2 + E_4 \\
LNIMRR = V_5 &= \beta_{03} + \beta_{22} \cdot F_2 + E_5 \\
LNOMRR = V_6 &= \beta_{02} + \beta_{23} \cdot F_2 + E_6
\end{aligned}
\tag{3-11}
$$

This is demonstrated by the path diagram in Figure 3.4.

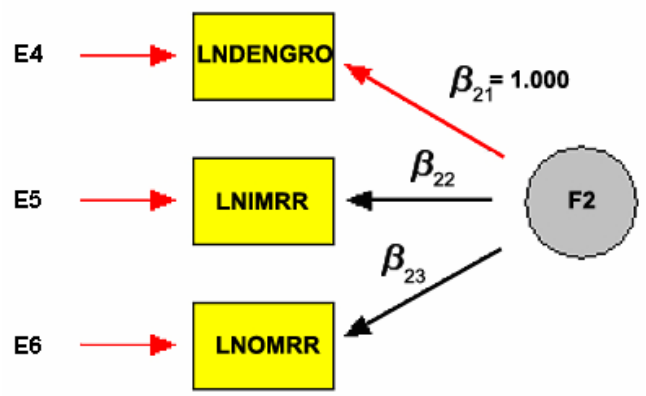


Figure 3.4 Path Diagram for a Factor Analysis Model of the Population Growth

Ignoring the mean and intercept parameters, there are seven parameters that require estimations from the data: the regression coefficients (β_{21}, $\beta_{22,}$ and β_{23}) and the variances *(Var(F_2), Var(E_4), Var(E_5),* and *Var(E_6))*. The six statistics available for use in the parameter estimations are *Var(V_4), Var(V_5), Var(V_6), Cov(V_4,V_5), Cov(V_4,V_6),* and *Cov(V_5, V_6)*. The model is under-identified, but if either *Var(F_2)* is constrained to be 1 or one of the regression coefficients is constrained to be 1, then the model would be over-identified. Therefore, in order to get an over-identified estimated factor analysis model of the population growth measurements, the regression coefficient for rate of change in density (*LNDENGRO* or V_4) is constrained to be 1 (β_{21}=1).

The Socioeconomic Development Measurement Model

The socioeconomic development for 2000 is measured by the variables of 2000, the housing dimension index for 2000 (*HOUS_00*), education dimension index (*EDUC_00*), and the economic opportunity dimension index (*ECON_00*). The measurement model for the socioeconomic development for 2000 is

$$\begin{aligned} EDUC_00 = V_7 &= \gamma_{01} + \gamma_{31} \cdot F_3 + E_7 \\ ECON_00 = V_8 &= \gamma_{02} + \gamma_{32} \cdot F_3 + E_8 \\ HOUS_00 = V_9 &= \gamma_{03} + \gamma_{33} \cdot F_3 + E_9 \end{aligned} \tag{3-12}$$

This is illustrated by the path diagram in Figure 3.5.

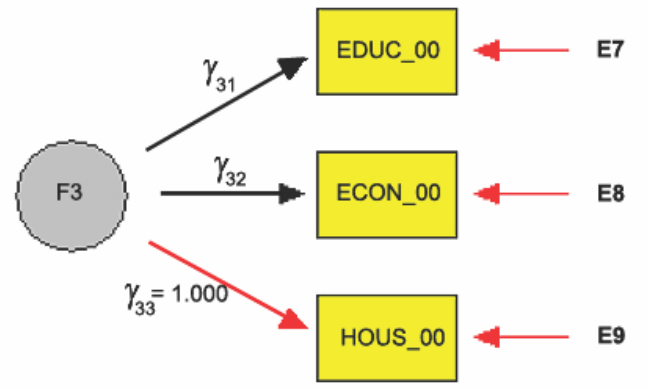


Figure 3.5 Path Diagram for a Factor Analysis Model of the 2000 Social Development

Ignoring the mean and intercept parameters, there are seven parameters that needed an estimation from the data: the regression coefficients (γ_{31}, $\gamma_{32,}$ and γ_{33}) and the variances (*Var*(F_3), *Var*(E_7), *Var*(E_8), and *Var*(E_9)). The six statistics available for use in the parameter estimations are *Var*(V_7), *Var*(V_8), *Var*(V_9), *Cov*(V_7,V_8), *Cov*(V_7,V_9), and *Cov*(V_8, V_9). The model is under-identified, but one of the regression coefficients is constrained to be 1; this would make the model over-identified. In the socioeconomic

development for the 2000 model, the regression coefficient for the housing dimension index is constrained to be 1.

3.4.2.2 Full Structural Equation Model I

The latent variable model encompasses the structural equations that summarize the relationship between latent variables. The following structural equation model analyzes the relationship between the three latent variables.

$$
\begin{aligned}
PINCGRO &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\
EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\
ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3 \\
LNDENGRO &= V_4 = \alpha_{04} + \alpha_{21} \cdot F_2 + E_4 \\
LNIMRR &= V_5 = \alpha_{05} + \alpha_{22} \cdot F_2 + E_5 \\
LNOMRR &= V_6 = \alpha_{06} + \alpha_{23} \cdot F_2 + E_6 \\
EDUC_00 &= V_7 = \alpha_{07} + \alpha_{31} \cdot F_3 + E_7 \\
ECON_00 &= V_8 = \alpha_{08} + \alpha_{32} \cdot F_3 + E_8 \\
HOUS_00 &= V_9 = \alpha_{09} + \alpha_{33} \cdot F_3 + E_9 \\
F_1 &= \alpha_{41} \cdot F_2 + D_1 \\
F_2 &= \alpha_{42} \cdot F_1 + D_2 \\
F_3 &= \alpha_{43} \cdot F_1 + \alpha_{44} \cdot F_2 + D_3
\end{aligned}
\tag{3-13}
$$

In the path diagram (Figure 3.6), the observed variables (*Y*s) are enclosed in square boxes, and causal links are represented by single headed arrows. Unobserved variables or latent variables, or factors *F1*, *F2* and *F3,* are enclosed in the circle. The measurement errors, *E*s, are not enclosed by a box. The assumption is *Y*s and *E*s are uncorrelated. It is also assumed that the *E*s have a mean of zero and constant variance, *Var(E).* The structural relationship is represented by the following equation:

$$
\begin{aligned}
F_1 &= \alpha_{41} \cdot F_2 + D_1 \\
F_2 &= \alpha_{42} \cdot F_1 + D_2 \\
F_3 &= \alpha_{43} \cdot F_1 + \alpha_{44} \cdot F_2 + D_3
\end{aligned}
\tag{3-14}
$$

Here *F1,* is a combination of two components: that arising from (caused by) *F2* and that arising from all other causes and summarized in a random deviation *(D1).* *F2* is a combination of two components: that arising from (caused by) *F1* and that arising from all other causes and summarized in a random deviation *(D2).* *F1* and *F2* have an interdependence relationship or simultaneous relationship. *F3* is a combination of three components: that arising from (caused by) *F1* and *F2* and that arising from all other causes and summarized in a random deviation *(D3).* Note that *F1, F2,* and *F3* are now dependent variables.

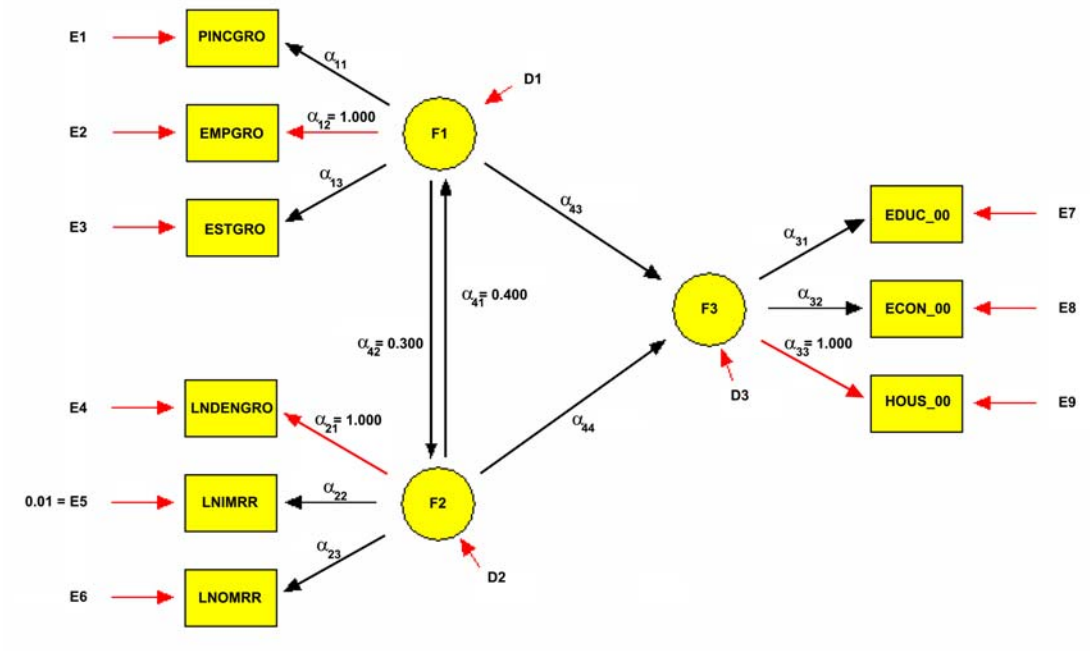


Figure 3.6 Path Diagram of the Full Structural Equation Model I for the Southeast Socioeconomic Development for 2000

Table 3.6 is a summary of the identification status of the nonrecursive path model as a function of characteristics. Nonrecursive models are not always identified. There are certain conditions that need validation upon whether a nonrecursive model meets the requirements of identification.

Table 3.6 Requirements for the Identification of Nonrecursive Path Model I

Model Characteristics		Identification Status	
Pattern of Disturbance Correlations	Feedback Loop?	Conditions for Identification	Necessary or Sufficient?
All possible pairwise	Yes	1. Parameters ≤ observations	Necessary
		2. Order Condition	Necessary
		3. Rank condition	Sufficient

*Source: (Kline, 1998)

The initial condition prerequisite for identification is that there be at least as many observations as parameters (the parameters ≤ observations) (Kline, Rex B., 1998) "The parameters of a nonrecursive path model are equal to the summation of (1) variances and covariances (unanalyzed associations) of the exogenous latent factors, (2) number of measurement errors, (3) number of disturbances, and (4) direct effects on latent endogenous factors from other factors (i.e., path coefficients)"(Kline, Rex B., 1998). Ignoring the mean and intercept parameters, there are 103 parameters. The total number of variances and covariances of exogenous latent factors is $78 = (12 \cdot 13)/2$. The total number of measurement errors is 9. The total number of disturbances is 3, and the total number of direct effects on latent endogenous factors from other factors is 13. Consequently, total parameters number 103. Since there are 9 observed variables in the

model, number of observations is $45 = (9 \cdot 10)/2$. The number observation is not the sample size (number of cases). It is the number variances and covariances among the observed variables. Thus, this model is definitely under-identified.

Based on the measurement model estimation, in order to estimate the structural equation model factor loading for α_{11}, α_{21}, and $\alpha_{31,}$ they are constrained to be 1; α_{41} is constrained to be 0.40, α_{42} is constrained to be 0.30, and E_6 is constrained to 0.01. Now the number of observed variables are equal to 15, and the number of observations is $120 = (15 \cdot 16)/2$. The number of parameters is 103, and the number of observation is 120, which is the first necessary condition for satisfaction.

The next, or second condition, concerns order condition, which necessitates that the number of excluded variables for each endogenous variable equals or exceeds the total number of endogenous variables minus one (Number of excluded variables ≥ number of endogenous variables-1) (Kline, Rex B., 1998). The structural equation model satisfies the second necessary condition as the order condition; with 10 endogenous variables, it must have at least 10 excluded from the equation of endogenous variables, thus, the number of excluded variables is ≥ 10 - 1. This condition is true here: *PINCGRO*, *EMPGRO*, and *ESTGRO* were excluded from the equations for *LNDENGRO, LNIMRR, LNOMRR, EDUC_00, ECON_00, HOUS_00*. *LNDENGRO, LNIMRR,* and *LNOMRR* were excluded from the equations of *PINCGRO*, *EMPGRO, ESTGRO, EDUC_00, ECON_00,* and *HOUS_00.* *EDUC_00, ECON_00,* and *HOUS_00* were excluded from the equations of *PINCGRO*, *EMPGRO, ESTGRO*, *LNDENGRO, LNIMRR,* and *LNOMRR.* The number of excluded variables is 9.

The order condition is essential for identification but not adequate; therefore, it may not be understood whether the nonrecursive model (with all possible disturbance of Figure 3.6) is actually identified. The sufficient rank condition examines a condition which provides insight on obtaining a solution.

Table 3.7 Evaluation of the Rank Condition for Nonrecursive Model I of Figure 3.6

System matrix

	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8	v_9	F_1	F_2	F_3
F_1	1	1	1	0	0	0	0	0	0	1	1	0
F_2	0	0	0	1	1	1	0	0	0	1	1	0
F_3	0	0	0	0	0	0	1	1	1	1	1	1

Evaluation for F_1

	v_4	v_5	v_6	v_7	v_8	v_9	F_3	
F_2	1	1	1	0	0	0	0	$\longrightarrow Rank = 2$
F_3	0	0	0	1	1	1	1	

(equal to (3-1))

Evaluation for F2

	v_1	v_2	v_3	v_7	v_8	v_9	F_3	
F_1	1	1	1	0	0	0	0	$\longrightarrow Rank = 2$
F_3	0	0	0	1	1	1	1	

(equal to (3-1))

Evaluation for F3

	v_1	v_2	v_3	v_5	v_6	v_7	
F_1	1	1	1	0	0	0	$\longrightarrow Rank = 2$
F_2	0	0	0	1	1	1	

(equal to (3-1))

The rank condition is evaluated using the system matrix (Kline, Rex B., 1998). Similar to the order condition, the rank condition must be evaluated for the equation of each endogenous variable of the model with all possible disturbance correlations. The rank condition is satisfied for the equation of this endogenous variable if the rank of the reduced matrix is greater than or equal to the total number of endogenous variable minus

1. When the rank condition is satisfied for all endogenous variables, the model will be categorized as identified (Kline, Rex B., 1998). From Table 3.7, the rank condition was satisfied, thus, the model was identified.

Nonrecursive structural equation model I is theoretically identified are still subject ot empirical underidentification, because (1) multicollinearity and (2) certain direct effects are close to zero (especially for direct effects on variables involved in feedback loops). If model is identified, direct and indirect effects on endogenous variables will be calculated.

3.4.2.3 Full Structural Equation Model II

The Full Structural Model I describes the causal relationship between variables in the previous section. However, the exogenous variables applied into the full structural equation model allow defensible conclusions. Initially, where it is reasonable to rule out causal roles for latent variables on earlier ones (a variety of special effects such as age, race, socioeconomic development in 1990, gravity into a large city, rural and urban continuum, and coastal and non-coastal county differences), the number of contending causal patterns that need to be regarded are drastically reduced. Secondly, models are introduced that examine the causal effects between factors, rather than directly between factors and their indicator variables. Relationships between factors give better estimates of effects between variables in which there are activities to eradicate some of the effects of measurement errors. The following structural equation model is generated as this study's focal point:

$$
\begin{aligned}
PINCGRO &= V_1 = \alpha_{01} + \alpha_{11} \cdot F_1 + E_1 \\
EMPGRO &= V_2 = \alpha_{02} + \alpha_{12} \cdot F_1 + E_2 \\
ESTGRO &= V_3 = \alpha_{03} + \alpha_{13} \cdot F_1 + E_3 \\
LNDENGRO &= V_4 = \alpha_{05} + \alpha_{21} \cdot F_2 + E_4 \\
LNIMRR &= V_5 = \alpha_{06} + \alpha_{22} \cdot F_2 + E_5 \\
LNOMRR &= V_6 = \alpha_{07} + \alpha_{23} \cdot F_2 + E_6 \\
EDUC_00 &= V_7 = \alpha_{08} + \alpha_{31} \cdot F_3 + E_7 \\
ECON_00 &= V_8 = \alpha_{02} + \alpha_{32} \cdot F_3 + E_8 \\
HOUS_00 &= V_9 = \alpha_{03} + \alpha_{33} \cdot F_3 + E_9 \\
F_1 &= \alpha_{41} \cdot F_2 + \alpha_{42} \cdot V_{10} + \alpha_{43} \cdot V_{11} + \alpha_{44} \cdot V_{12} + \alpha_{45} \cdot V_{13} \\
&\quad + \alpha_{46} \cdot V_{14} + \alpha_{47} \cdot V_{15} + \alpha_{48} \cdot V_{16} + \alpha_{49} \cdot V_{17} + \alpha_{50} \cdot V_{18} + D_1 \\
F_2 &= \alpha_{51} \cdot F_1 + \alpha_{52} \cdot V_{10} + \alpha_{53} \cdot V_{11} + \alpha_{54} \cdot V_{12} + \alpha_{55} \cdot V_{13} \\
&\quad + \alpha_{56} \cdot V_{14} + \alpha_{57} \cdot V_{15} + \alpha_{58} \cdot V_{16} + \alpha_{59} \cdot V_{17} + \alpha_{510} \cdot V_{18} + D_2 \\
F_3 &= \alpha_{61} \cdot F_1 + \alpha_{62} \cdot F_2 + \alpha_{63} \cdot V_{10} + \alpha_{64} \cdot V_{11} + \alpha_{65} \cdot V_{12} \\
&\quad + \alpha_{66} \cdot V_{13} + \alpha_{67} \cdot V_{14} + \alpha_{68} \cdot V_{15} + \alpha_{69} \cdot V_{16} + \alpha_{610} \cdot V_{17} + \alpha_{611} \cdot V_{18} + D_3
\end{aligned}
\tag{3-15}
$$

Figure 3.7 is the path diagram of the structural equation model II. Because of difficulties of drawing all the arrows, the lines were simplified by categories in which one line arrow was used. The latent dependent variables were F_1, F_2, and F_3. *PINCGRO, EMPGRO, ESTGRO*, *LNDENGRO, LNIMRR*, *LNOMRR, EDUC_00, ECON_00* and *HOUSE_00* are referred to as the dependent variables (*Y*s). The random deviations or residuals (E_1, E_2, E_3, E_4, E_5, E_6, E_7, and E_8) are specific factors; the regression coefficients (α_{11}, α_{12}, α_{13}, α_{14}, α_{21}, α_{22}, α_{23}, α_{31}, α_{32}, and α_{33}) are factor loadings. *LNNATINC, LNRACE, MEDAGE, ECON_90, EDUC_90, HOUS_90, LNGRAV, RUC*, and *COAST* are exogenous/independent variables (*X*s). In the above path diagrams, observed variables (*Y*s and *X*s) are enclosed in square boxes, and causal links are represented by single headed arrows. Xs are correlated, and these associations between

Xs are represented by two-headed arrows. Unobserved variables or latent variables or factors *F1*, *F2* and *F3* are enclosed in circles. The measurement errors, *E*s, are not enclosed by a box. The assumption is *Y*s and *E*s are uncorrelated. It is also assumed that the *E*s have a mean of zero and constant variance, *Var(E)*.

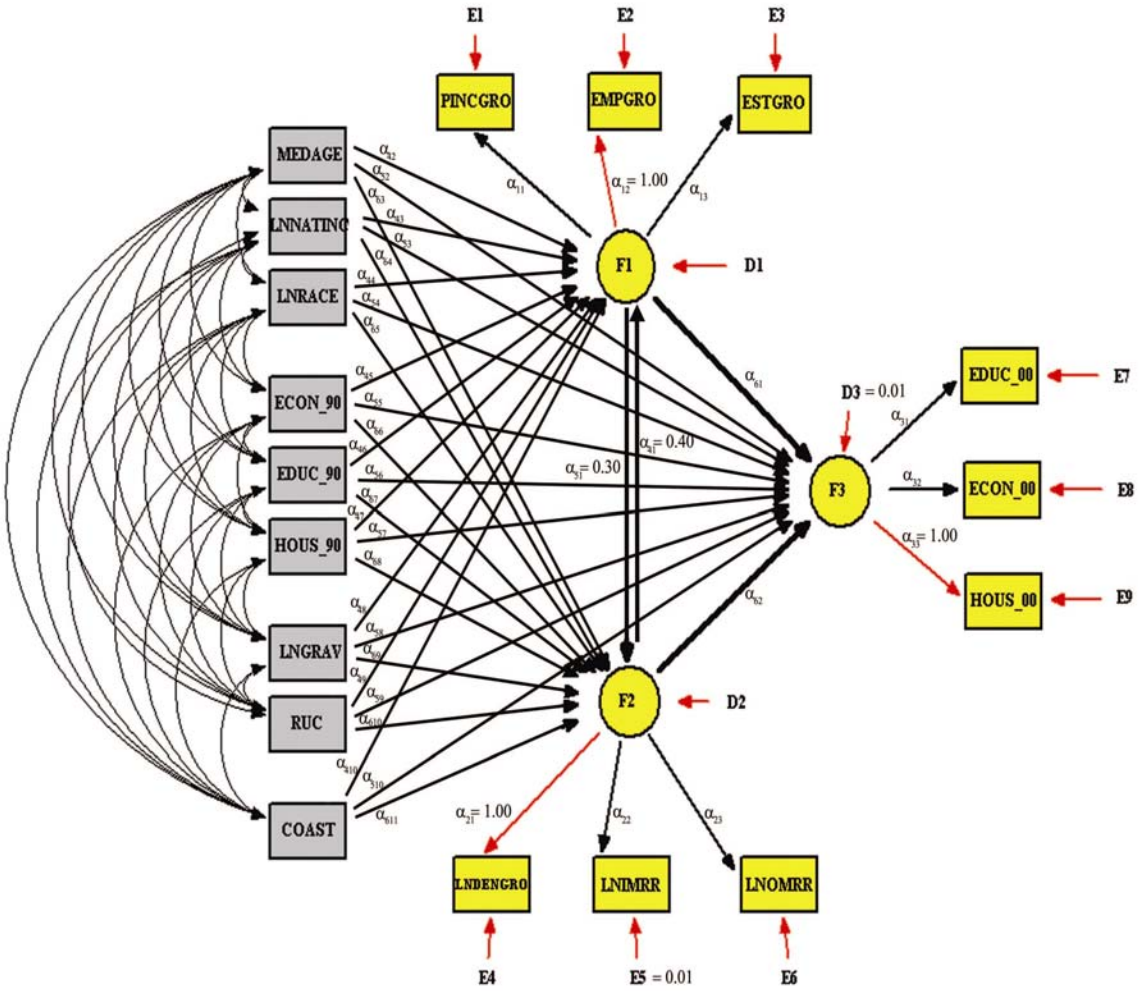


Figure 3.7 Path Diagram for the Full Structural Equation Model II for the Southeast Socioeconomic Development for 2000

Tables 3.8 and 3.9 are a summary of the identification status of the nonrecursive path model as a function of their characteristics. The Full Structural Equation Model II is identified since the exogenous variables (observed variables) are added into the Full Structural Model I. Direct and indirect effects of all exogenous variables are estimated.

Table 3.8 Requirements for the Identification of Nonrecursive Path Model II

Identification Status		
Conditions for Identification	Calculation	Necessary or Sufficient?
1. Parameters ≤ observations	Number of parameters is 283 (21 variables: 220=21(22)/2; 23 variances (9 X's, 10 E's, and 3 D's); 40 direct effects on the endogenous variables). Number of observations is 325 (25(26)/2 = 325).	Necessary condition is satisfied
2. Order Condition	Number of excluded variables ≥ number of endogenous variables: Number of endogenous variables is 13. Therefore, at least 12 excluded variables are required. The number of excluded variables is 13, which is the same as Full Structural Model I.	Necessary condition is satisfied.
3. Rank condition	Table 4.4 shows evaluation of ranking condition for Full Structural Model II	Sufficient condition is satisfied.

Table 3.9 Evaluation of the Rank Condition for Nonrecursive Model II of Figure 3.7

System matrix

	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8	v_9	v_{10}	v_{11}	v_{12}	v_{13}	v_{14}	v_{15}	v_{16}	v_{17}	v_{18}	F_1	F_2	F_3
F_1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0
F_2	0	0	0	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0
F_3	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Evaluation for F_1

	v_4	v_5	v_6	v_7	v_8	v_9	F_3	
F_2	1	1	1	0	0	0	0	$\longrightarrow Rank = 2$
F_3	0	0	0	1	1	1	1	

(equal to (3-1))

Evaluation for F2

	v_1	v_2	v_3	v_7	v_8	v_9	F_3	
F_1	1	1	1	0	0	0	0	$\longrightarrow Rank = 2$
F_3	0	0	0	1	1	1	1	

(equal to (3-1))

Evaluation for F3

	v_1	v_2	v_3	v_5	v_6	v_7	
F_1	1	1	1	0	0	0	$\longrightarrow Rank = 2$
F_2	0	0	0	1	1	1	

(equal to 3-1))

3.4.3 GIS Modeling Approach Using ArcMap and GeoDa

GIS analysis is a process of looking at geographical pattern(s) in data and at relationships between features. There are three methods of using GIS for data analysis (Mitchell, Andy, 1999, 2005), (Kline, Rex B., 1998), and (Anselin, Luc, 1988, 1999a, b, 2000, 2003a, b). The methods are:

1) Creating maps - This is the least complex and quickest method of GIS analysis. It shows approximate information about the spatial pattern(s) or distribution.
2) GIS Modeling - GIS raster modeling involves models that mimic the real world by combining many data layers based on the results of the statistical/econometric analysis. This method helps to create new information that was unavailable before through the use of ArcMap raster tools. Spatial lag regression modeling involves spatial econometrics and runs spatial regression analysis using GeoDa.
3) GIS spatial analysis: GIS spatial analysis is the method that uses spatial statistical tools in order to describe the distribution of a set of features, to discern patterns, and to measure relationships between features for information on a map form or GIS models.

Figure 3.8 shows the steps for building a conceptual spatial model for solving spatial problems. The outcome of the analysis can be displayed as a map or as values in a table or chart. The use of statistical analysis is used to verify the results.

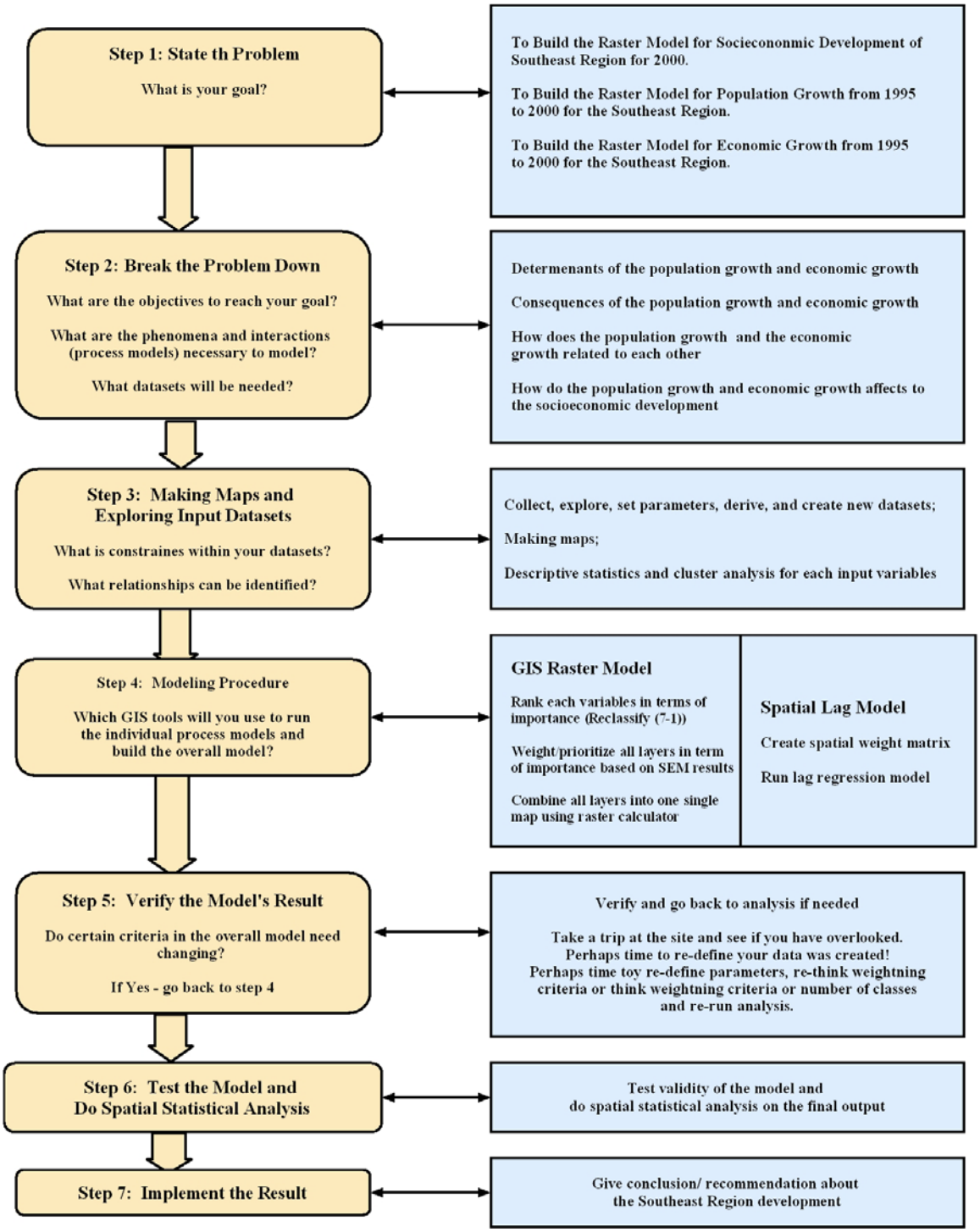


Figure 3.8 Steps for Building a Conceptual Spatial Model

3.4.3.1 GIS Raster Modeling

Figure 3.9 shows the master flow chart design for the GIS raster modeling analysis; it deals with the main approach towards GIS mapping, modeling, and spatial statistical analysis.

The steps used in the GIS analysis include making/creating maps, exploring input dataset, procedure of modeling, and spatial statistical analysis towards the GIS model result(s).

The creation of maps, in turn, requires the creation and projection of a point file, creation of a mask grid, and spline interpolation. The creation of a point file requires that all the numerical data be defined by the (x, y) coordinate locations in space (i.e. converted into a discrete geographic feature). The projection of the point file refers to the projection onto the North American Datum of 1983 (NAD1983.) Then a mask grid is created for the raster layers.

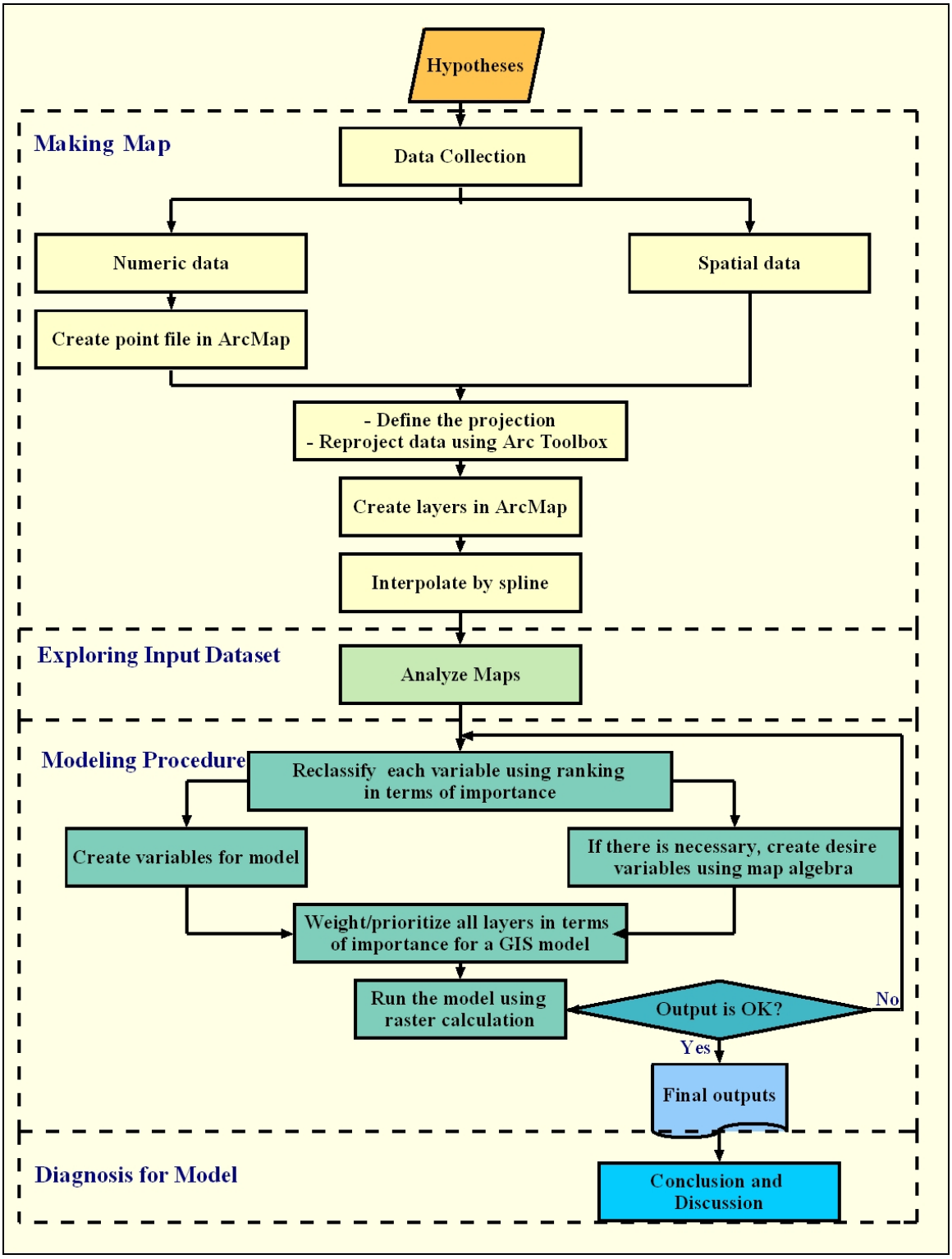


Figure 3.9 Master Flowchart Design for GIS Raster Modeling Analysis

All numerical data is created in the point file with (x, y) coordinate locations where the center of a county was the "centriod" spot. This data is expressed in point features and measured the whole county summary information. However, it is possible to assume that these point features data are sample points of the southeast region with irregularity spaced over the southeast region. Because it is not able to measure the values of the particular phenomenon in all points of the sphere of each county, it is impossible to find data for the east/west/north/south part of a county boundary. Therefore, non-continuous data is changed into continuous data (for a given place) in order to create maps showing how quantity varies across the place. GIS employs these points to allocate values to the area between points in a process defined as interpolation (Mitchell, Andy, 1999).

In this research, a map land value(s) was created by interpolation by "spline" from the center points of all the parcels in a county. Spline interpolation is where the interpolant is a special type of piecewise polynomial called a spline (Vrcelj, Bojan and P. P. Vaidyanathan, 2001). Spline interpolation is recommended over polynomial interpolation because the interpolation error is smaller even when employing low degree polynomials for the spline (Meijering, Erik H. W., 2000).

After the spline interpolation, the maps are analyzed for continuity and completeness; in other words, they were analyzed for varible ranking, i.e., the relationship between the variables and strengths of exogenous variables toward endogenous variables. Then the modelling procedure is started.

Creating maps and exploring input datasets focus on the features in a single layer. The modeling procedure deals with the relationship between two or more layers. Modeling procedure is a step-by-step process that combines entire layers on top of each other in order to study the spatial relationship that provides significant and beneficial visual comprehension.

In order to combine all layers together (explicitly - to build a conceptual model), the first step is to rank each variable in terms of importance using the reclassification tool. Ranking positions features are in the order from high to low. Ranks are used when direct measures are complicated or if the quantity represents a combination of factors. Consider the race effect towards the economic growth example; the race effect variable is the ratio of percentage of nonwhite population to percentage of white population. For the economic growth factor, if white population growth is dominant, it will have a positive relationship with the economic growth factors. If the nonwhite population is decreasing rapidly, it would also have a strong positive effect toward economic growth. At the same time, if the nonwhite population was majority, it would show a negative influence towards the total number of people employed, per capita personal income, etc. Based on this conceptual framework, large shares of white or other population, as well as lower share of black population (the ratio is more than 1 or approaches to zero), will get a higher-ranking number. A large share of black population (the ratio is less than 1 and far from to zero) will get a lower ranking number. The ranking for each variable is scaled from 1 to 7. Ranks are relative. For instance, it may be known that a feature with a rank of 3 is higher than one ranked 2 and lower than a 4, but it is not known how much higher

or lower (Mitchell, Andy, 1999). Based on the ranking information, each race group is classified in an equal interval scheme. The equal interval scheme, known as the difference between the high and low values, is the same for every class. After reclassification of variables for each race group, the three layers are combined together using map algebra in the raster calculator. This creates the race effect variable. Again, the race effect variable is ranked in terms of importance to the economic growth model and reclassified again in the equal interval schema. The variable ranking and reclassification procedure is employed for every variable in the model, but each variable has its own distinct characteristics.

After ranking and reclassifying each variable for each model, all layers are weighted – prioritized in terms of importance based on the structural equation model results for each model. Finally, all layers are combined into one solitary map using the raster calculator for each model. There are three final output maps in this study:

1. The Social Development of the Southeast Region, 2000
2. Population Growth for the Southeast Region, 1995-2000
3. Economic Growth for the Southeast Region, 1995-2000.

There are also nine final output maps for the endogenous variables.

3.4.3.2 Spatial Lag Model

The function of linear regression analysis finds a linear relationship between a dependent variable and a set of explanatory variables:

$$y = X\beta + e \tag{3-16}$$

The method for linear regression is the method of ordinary least squares (OLS) that determines estimated (predicted) Y values as close as possible to actual (observed) Y by minimizing the sum of residuals. The least square estimator satisfies the Gauss-Markov theorem: best linear unbiasedness property of an estimator (BLUE). To get the BLUE property and construct statistical inferences about the population regression coefficients from the estimated b, certain assumptions about the random error of the regression equation should be made (Guijarati, Damodar N., 1995). These include (Guijarati, Damodar N., 1995):

1) Zero mean value of the disturbance e_i: $E(e_i \mid X_i) = 0$
2) Homoscedasticity or equal variance of e_i: $\text{var}(e_i \mid X_i) = \sigma^2$
3) No autocorrelation between the disturbances: $\text{cov}(e_i, e_j \mid X_i, X_j) = 0$
4) The disturbances have a normal distribution.

These assumptions may not be always satisfied. There is a spatial dependence whenever a value observed in one location is dependant on the values observed at neighboring locations. In the classical regression model, there are no spatial effects or spatial dependence (Anselin, Luc and Anil K. Bera, , Anselin, Luc, 2003b). Spatial data may show spatial dependence in the variables and error terms (Anselin, Luc and Anil K. Bera, , Baller, Robert D., et al., 2001).

There are two common reasons for spatial dependence. The first is because data collection of observations associated with spatial units may reflect measurement error. This occurs when the boundaries for which information is collected do not precisely

reflect the nature of the underlying process generating the sample data (Anselin, Luc and Anil K. Bera, , Anselin, Luc, 2003b, Baller, Robert D., et al., 2001, Messner, Steven F. and Luc Anselin, , Zhang, Charles, 2006) The second reason for spatial dependence is that the spatial dimension of a social or economic characteristic may be a significant aspect of the phenomenon (Anselin, Luc and Anil K. Bera, , Anselin, Luc, 2003b, Baller, Robert D., et al., 2001, Messner, Steven F. and Luc Anselin, , Zhang, Charles, 2006) There are two principal types of spatial dependence, or spatial autocorrelation. These are sometimes called a spatial error or spatial lag (Baller, Robert D., et al., 2001).

1) Spatial error model refers to the error terms across different spatial units that are correlated

$$\begin{aligned} &OLS: && y = X\beta + e, && where \quad e \sim N(0,\sigma^2) \\ &Spatial\ Error\ \ Model: && y = X\beta + e + \lambda We, && where \lambda \neq 0 \end{aligned} \tag{3-17}$$

2) Spatial lag model refers to the dependent variable y is affected by the values of neighboring dependent variables

$$\begin{aligned} &OLS: && y = X\beta + e, && where \quad e \sim N(0,\sigma^2) \\ &Spatial\ Error\ \ Model: && y = \rho Wy + X\beta + e, && where \quad \rho \neq 0 \end{aligned} \tag{3-18}$$

In the spatial error case, OLS method provides unbiased and consistent estimates; however, the estimates are not efficient (Anselin, Luc, 2003b). The reason is the violation of the assumption of uncorrelated error terms. In the spatial lag case, the OLS method provides biased and inconsistent estimates (Anselin, Luc, 2003b, Baller, Robert D., et al., 2001, Messner, Steven F. and Luc Anselin) The reason is that both the

assumption of uncorrelated error terms and the assumption of no autocorrelation between error terms are violated. Spatial lags indicate a probable diffusion process. (Baller, Robert D., et al., 2001) This occurs when an event(s) in one place may predict an increased likelihood of similar events in neighboring places (Baller, Robert D., et al., 2001) GeoDa provides an assortment of diagnostics to detect spatial dependence. It also offers unbiased regression estimates using a Maximum Likelihood approach (ML Spatial Lag or Spatial Error models), which is used in this study.

In order to estimate a spatial lag regression model with GeoDa, the first process is to create a spatial weight matrix and then run the spatial regression using a maximum likelihood estimation approach. The following lag spatial model was calculated for all dependent variables.

$$y = \rho Wy + X\beta + e \tag{3-19}$$

where y - dependent variable, ρ - the coefficient of the spatially lagged dependent variable, W - spatial weight matrix, Wy - spatial lagged variable, X - exogenous variables (not lagged dependent), β - vector of parameters associated with X variables, and e - error terms.

The following equations were estimated in Chapter V:

1) Economic Growth Variables:

$$\begin{aligned} y_1 &= \rho_{11} Wy_1 + \beta_{10} + \beta_{11} X_1 + \beta_{12} X_2 + \beta_{13} X_3 + \beta_{14} X_4 + \beta_{15} X_5 + \beta_{16} X_6 + \beta_{17} X_7 + \beta_{18} F_1 + \beta_{19} F_2 \\ y_2 &= \rho_{21} Wy_2 + \beta_{20} + \beta_{21} X_1 + \beta_{22} X_2 + \beta_{23} X_3 + \beta_{24} X_4 + \beta_{25} X_5 + \beta_{26} X_6 + \beta_{27} X_7 + \beta_{28} F_1 + \beta_{29} F_2 \\ y_3 &= \rho_{31} Wy_3 + \beta_{30} + \beta_{31} X_1 + \beta_{32} X_2 + \beta_{33} X_3 + \beta_{34} X_4 + \beta_{35} X_5 + \beta_{36} X_6 + \beta_{37} X_7 + \beta_{38} F_1 + \beta_{39} F_2 \end{aligned} \tag{3-20}$$

2) Population Growth Variables:

$$\begin{aligned} y_4 &= \rho_{41} W y_1 + \beta_{40} + \beta_{41} X_1 + \beta_{42} X_2 + \beta_{43} X_3 + \beta_{44} X_4 + \beta_{45} X_5 + \beta_{46} X_6 + \beta_{47} X_7 + \beta_{48} F_1 + \beta_{49} F_2 \\ y_5 &= \rho_{51} W y_2 + \beta_{40} + \beta_{51} X_1 + \beta_{52} X_2 + \beta_{53} X_3 + \beta_{54} X_4 + \beta_{55} X_5 + \beta_{56} X_6 + \beta_{57} X_7 + \beta_{58} F_1 + \beta_{59} F_2 \\ y_6 &= \rho_{61} W y_3 + \beta_{60} + \beta_{61} X_1 + \beta_{62} X_2 + \beta_{63} X_3 + \beta_{64} X_4 + \beta_{65} X_5 + \beta_{66} X_6 + \beta_{67} X_7 + \beta_{68} F_1 + \beta_{69} F_2 \end{aligned} \quad (3\text{-}21)$$

3) Social Development Variables:

$$\begin{aligned} y_7 &= \rho_{71} W y_1 + \beta_{70} + \beta_{71} X_1 + \beta_{72} X_2 + \beta_{73} X_3 + \beta_{74} X_4 + \beta_{75} X_5 + \beta_{76} X_6 + \beta_{77} X_7 \\ &\quad + \beta_{78} F_1 + \beta_{79} F_2 + \beta_{710} F_3 \\ y_8 &= \rho_{81} W y_2 + \beta_{80} + \beta_{81} X_1 + \beta_{82} X_2 + \beta_{83} X_3 + \beta_{84} X_4 + \beta_{85} X_5 + \beta_{86} X_6 + \beta_{87} X_7 \\ &\quad + \beta_{88} F_1 + \beta_{89} F_2 + \beta_{810} F_3 \\ y_9 &= \rho_{91} W y_3 + \beta_{90} + \beta_{91} X_1 + \beta_{92} X_2 + \beta_{93} X_3 + \beta_{94} X_4 + \beta_{95} X_5 + \beta_{96} X_6 + \beta_{97} X_7 \\ &\quad + \beta_{98} F_1 + \beta_{99} F_2 + \beta_{910} F_3 \end{aligned} \quad (3\text{-}22)$$

4) F1 - economic growth from 1995 to 2000 factor:

$$F_1 = \rho_{101} W F_1 + \beta_{100} + \beta_{101} X_1 + \beta_{102} X_2 + \beta_{103} X_3 + \beta_{104} X_4 + \beta_{105} X_5 + \beta_{106} X_6 + \beta_{107} X_7 + \beta_{108} F_2 \quad (3\text{-}23)$$

5) F2 - population growth from 1995 to 2000 factor:

$$F_2 = \rho_{111} W F_2 + \beta_{110} + \beta_{111} X_1 + \beta_{112} X_2 + \beta_{113} X_3 + \beta_{114} X_4 + \beta_{115} X_5 + \beta_{116} X_6 + \beta_{117} X_7 + \beta_{118} F_1 \quad (3\text{-}24)$$

6) F3 - 2000 social development factor:

$$F_3 = \rho_{121} W F_3 + \beta_{120} + \beta_{121} X_1 + \beta_{122} X_2 + \beta_{123} X_3 + \beta_{124} X_4 + \beta_{125} X_5 + \beta_{126} X_6 + \beta_{127} X_7 + \beta_{128} F_1 + \beta_{129} F_3 \quad (3\text{-}25)$$

where, *y1-PINCGRO, y2-EMPGRO, y3-ESTGRO, y4-LNDENGRO, y5-LNIMRR, y6-LNOMRR, y7-ECON_00, y8-EDUC_00, y9-HOUS_00, F1*- Economic Growth Factor, *F2*- Population Growth Factor, *F3*-2000 Social Development Factor, *X1-LNNATINC, X2-LNRACE, X3-MEDAGE, X4-ECON_90, X5-EDUC_90, X6-HOUS_90*, and *X7-LNGRAV*.

3.5 Summary

Chapter III has discussed the variables and models specifications as well as examined the methods employed in this research. Chapter III also addressed the following four purposes/objectives:

1) An overview of the information about the dataset(s).
2) Presentation of the derivation of the variable estimates in the proposed models.
3) Discussion of all techniques and methods employed in the data analysis.
4) Demonstration of proposed model specifications in analytical detail.

CHAPTER IV

DATA AND ITS CHARACTERISTICS

The primary purpose of chapter IV is to provide general information about the dataset and the relationships among data using descriptive statistics analysis, spatial descriptive statistics analysis, and correlation analysis.

Analytical Framework: Descriptive statistics and spatial statistics analysis are employed in five natural break classes (highest, higher, medium, lower, and lowest) for each variable. In the natural break classes, the high and low value of each class is automatically determined by GIS mathematical procedure. It picks the class breaks that best group similar values and maximize the differences between clusters. Highest and higher classes are considered high category, and lower and lowest classes are considered low category. Spatial distribution of each variable is discussed, where hot spots (county with high value is surrounded by counties with high value) and cold spots (county with low values is surrounded by counties with low value) are examined. Concluding, the main purpose of this chapter is to describe where the economic growth, population growth, and social development are high and low, and provide how much growth differences and explanation about differences are possible. Comparisons are made in rural/urban and coastal/non-coastal differences and in states.

Dataset Structure: The investigation covered 11 states in the southeast region (excluding Virginia), which consisted of a total of 930 counties. The area is much more of an urban area than many people would assume. According to the 1993 rural and urban continuum code classification, 26.9% of the counties were located in metropolitan areas, and 47.8% were urban counties. The urban counties include both counties that had an urban population of 20,000 or more (13.5% of all urban counties) and counties that had an urban population of 2,500 to 19,999 (86.5% of all urban counties). Only 25.3% of the counties in the study area were completely rural counties or counties that had an urban population of less than 2,500. Figure 4.1 illustrates the rural and urban geographic distribution of the southeast region based on the 1993 rural and urban continuum code classification. Coastal areas are defined according to the Strategic Environmental Assessments Division of the National Oceanic and Atmospheric Administration (NOAA). Non-coastal counties are 77.8% of the total counties, while 22.2% of the total counties are coastal counties. Figure 4.2 illustrates the distribution of coastal and non-coastal counties in the southeast region.

Figure 4.4 illustrates the central feature (the shortest total distance from all other features) of the southeast region, which was Bartow County, Georgia. Bartow County was the most centrally located feature in the southeast region.

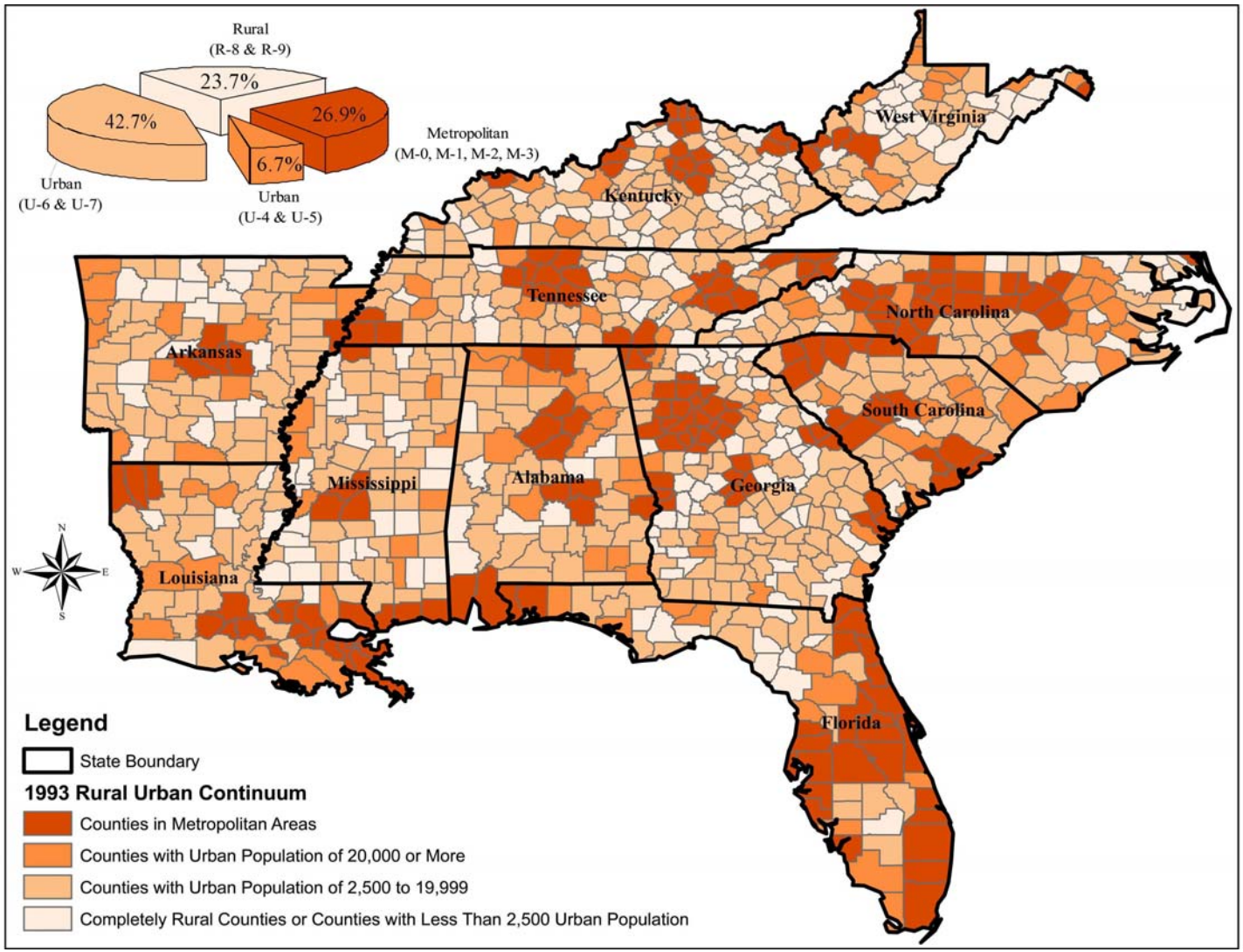


Figure 4.1 Rural and Urban Geographic Distribution of the Southeast Region

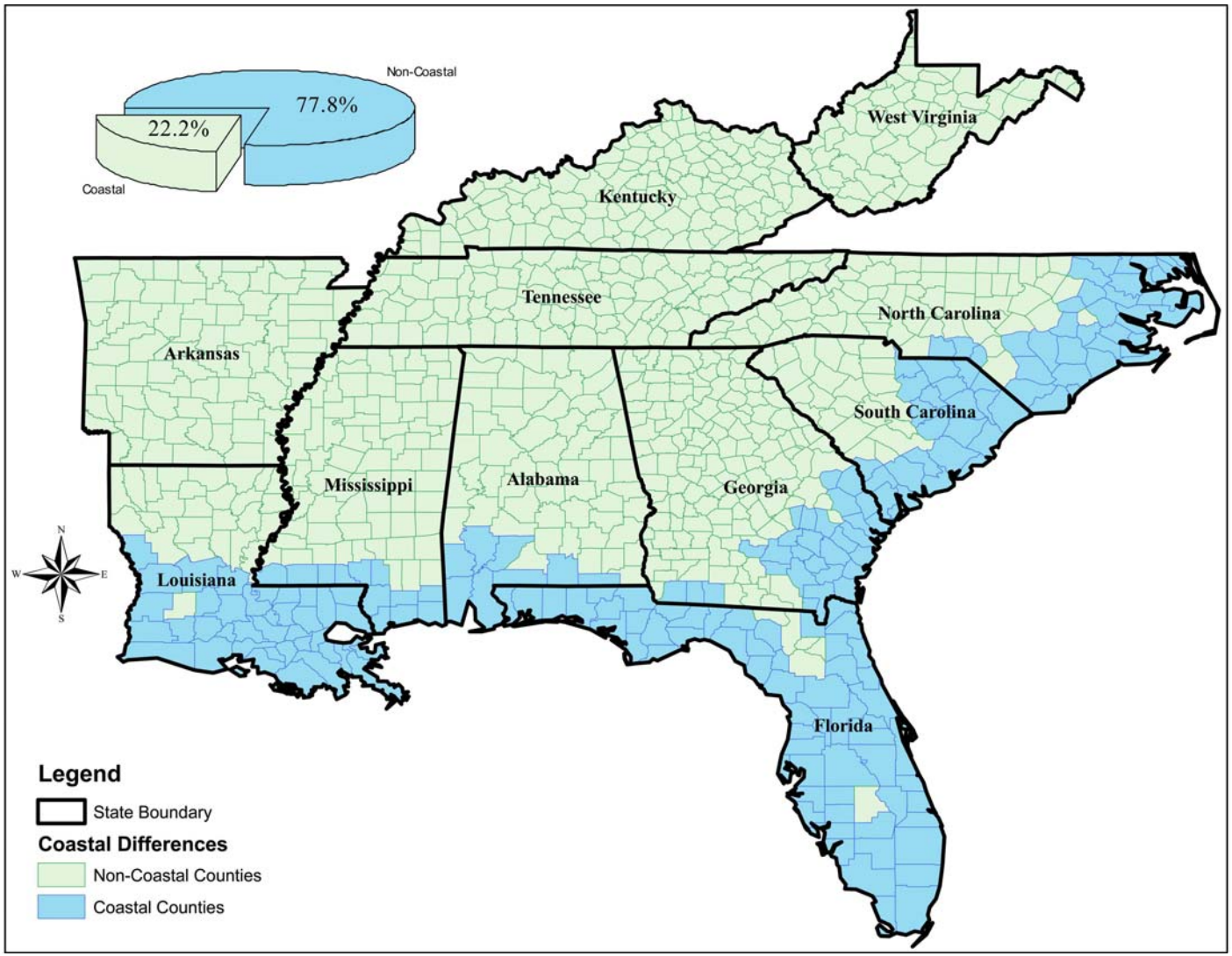


Figure 4.2 Coastal and Non-Coastal Counties in the Southeast Region

4.1 Analysis of Economic Growth Variables

4.1.1 Per Capita Personal Income

There are several main objectives covered in this section. The first objective is to provide the basic features of real per capita personal income dataset. The average annual real per capita personal income and its average annual rate of change from 1995 to 2000 is provided in Table 4.1. Figure 4.3 illustrates the average annual rate of change in real per capita personal income from 1995 to 2000 at the county level. Figure 4.4 demonstrates the geographic distribution of the average annual rate of change in real per capita personal income from 1995 to 2000.

On average, the southeast regional real per capita personal income increased by 11.4% (from $19,409.29 to $21,630.90) from 1995 to 2000. The average annual rate of change in the real per capita personal income (*PINCGRO*) for the southeast region was 1.0213, which meant on average, the real per capita personal income increased by 2.13% annually from 1995 to 2000. The range of *PINCGRO* was from 0.9874 (-1.26%) to 1.0932 (9.32%).

Table 4.1 The Average Real per Capita Personal Income in the 2000 Dollar Value Per County and the Average Annual Rate of Change, 1995 - 2000

RUC/Coastal /States	No. of Counties	Average Per Capita Personal Income in 2000 Dollar Value						*PINCGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	19409.29	19844.33	20380.11	21015.89	21311.24	21631.90	1.0213
Metro	250	22809.93	23281.94	23922.96	24912.25	25308.43	25871.87	1.0249
Urban 4 & 5	62	21247.28	21577.87	22173.56	22950.15	23166.13	23510.83	1.0199
Urban 6 & 7	397	18379.83	18753.98	19230.04	19750.86	19990.01	20154.89	1.0183
Rural	221	16896.07	17427.97	17935.17	18338.09	18642.59	18961.68	1.0230
Coastal	206	20045.03	20543.75	21124.47	21829.72	21997.95	22414.11	1.0218
Non-Coastal	724	19228.40	19645.32	20168.31	20784.34	21115.85	21409.33	1.0212
Alabama	67	19424.42	19518.31	19962.09	20646.39	20989.01	20928.83	1.0149
Arkansas	75	18527.83	19035.71	19447.14	19916.40	20175.79	20015.91	1.0153
Florida	67	21842.94	22310.78	22927.45	24034.52	24527.72	24842.95	1.0247
Georgia	159	20007.47	20600.88	20878.21	21545.48	22019.97	22229.29	1.0205
Kentucky	120	18011.75	18556.63	19258.62	19816.65	20047.77	20975.66	1.0305
Louisiana	64	18725.38	19054.24	19502.21	19951.72	19955.97	19893.48	1.0114
Mississippi	82	17309.38	17894.47	18394.65	18916.97	19012.77	19134.45	1.0198
N. Carolina	100	21425.76	22006.51	22874.15	23515.68	23736.16	24380.15	1.0259
S. Carolina	46	19598.69	20003.63	20691.83	21469.64	21949.63	22376.05	1.0265
Tennessee	95	20074.38	20164.36	20745.04	21356.26	21767.22	22151.50	1.0199
W. Virginia	55	17901.18	18171.14	18621.33	19228.83	19315.06	19714.76	1.0193

The second objective is to demonstrate the spatial relationships, which are the concentration, dispersion, and spatial distribution. Figure 4.3 and Figure 4.4 presented *PINCGRO* data, which is visualized into the 5 natural break classes; each class contained an equal number of features in the figures. From a total of 930 counties of the Southeast, 25.91% are in the high *PINCGRO* counties (4.73% - highest *PINCGRO,* and 21.18% - higher *PINCGRO*), 33.55% fit in the medium *PINCGRO* counties, and 40.54% belong to the low *PINCGRO* counties (29.14% - lower *PINCGRO*, and 11.4% - lowest *PINCGRO*).

The geographic distribution of *PINCGRO* and its identification toward cluster location (hot spots - high *PINCGRO* county is surrounded by high *PINCGRO* counties) and/or cold spots (low *PINCGRO* county is surrounded by low *PINCGRO* counties) are illustrated in Figure 4.3 and Figure 4.4. The eastern and northern areas contain many hot spots (especially in Kentucky, central and coastal areas of North & South Carolina, northern Georgia, areas in Florida, etc.), and the western area contains large cold spots (most areas of Arkansas, Alabama, Louisiana, West Virginia, western and southeastern Mississippi, southern Georgia, and western Tennessee). Since the northern and eastern parts of the southeast region have higher *PINCGRO* than the rest of the region, these areas might be places that pull/attract people to move inward. Perhaps these areas contain relatively more employment possibilities. Later, correlation analyses are provided. Additional specific analyses on clusters are examined in Chapter 5.

Figure 4.4 also provides the 1 standard deviational ellipses for the directional distribution of *PINCGRO*, which demonstrates the spatial distribution of *PINCGRO*. There are several spatial trends in a distribution of features. The spatial trends of *PINCGRO* follow the main highways, particularly interstates. Counties that are closer to the interstate highways have a higher *PINCGRO,* while counties that are more distant from the interstate highways have a lower *PINCGRO*.

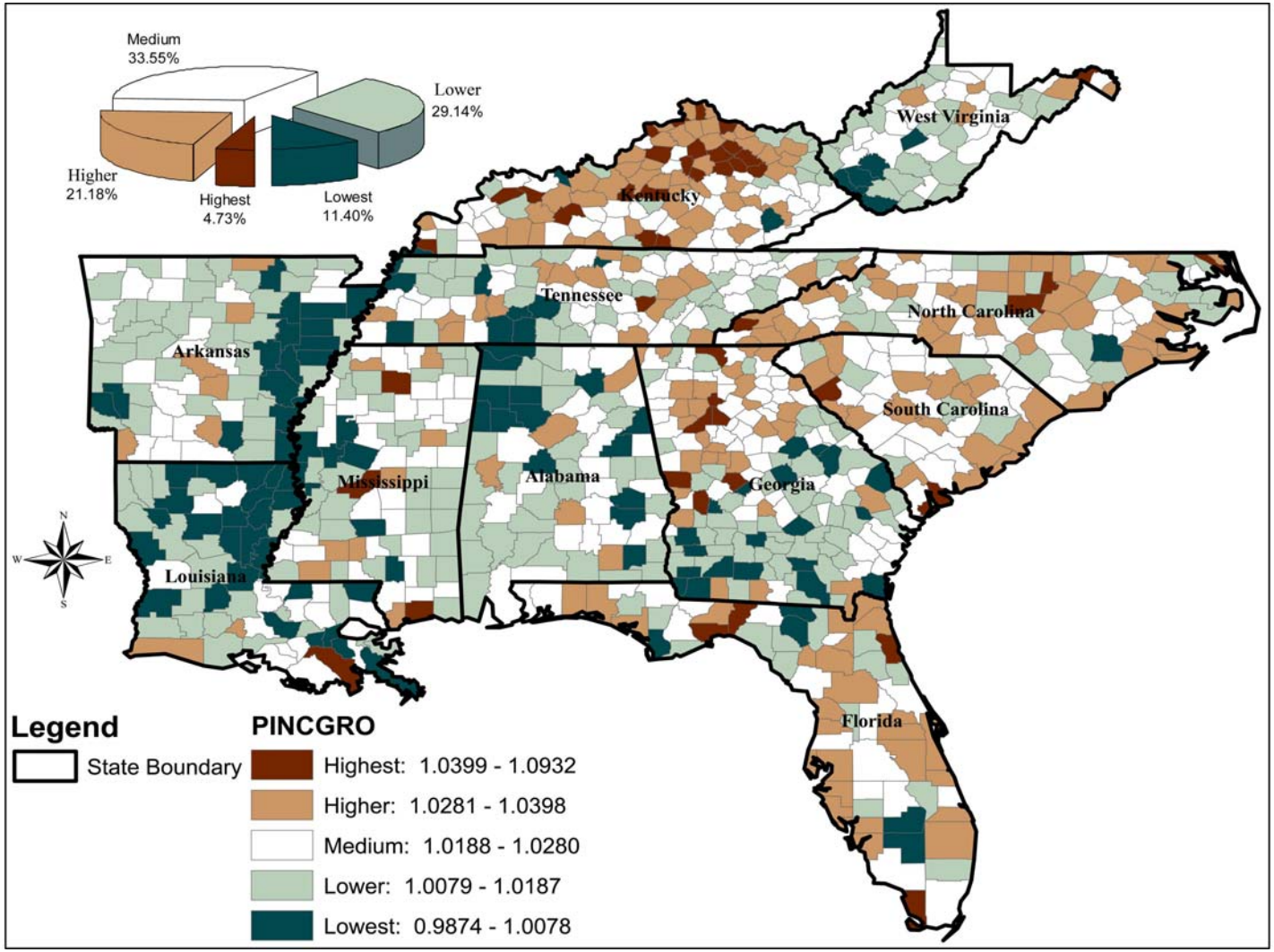


Figure 4.3 The Average Annual Rate of Change in the Real per Capita Personal Income for the Southeast Region, 1995 – 2000

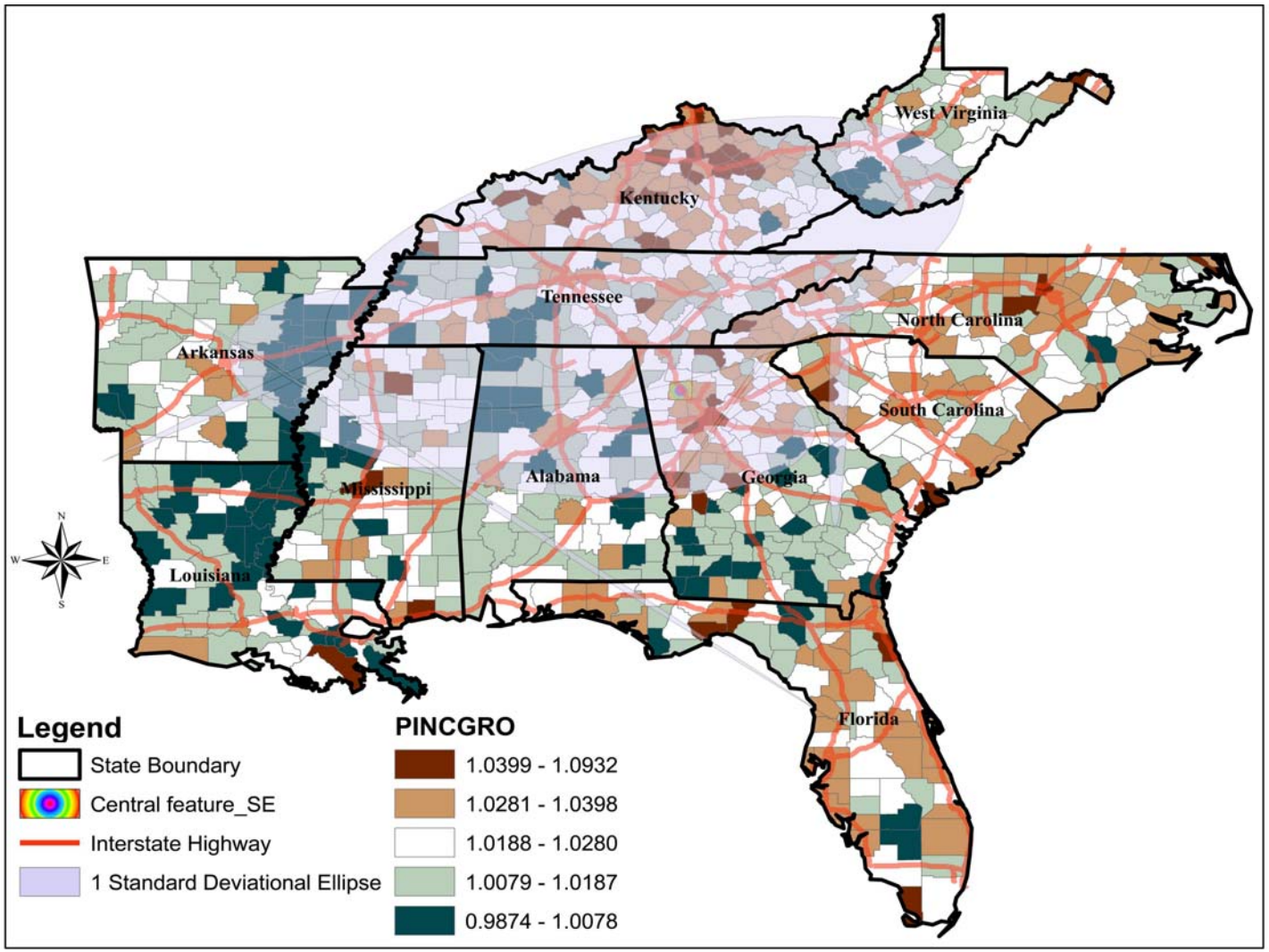


Figure 4.4 Spatial Distribution of the Average Annual Rate of Change in the Real per Capita Personal Income for the Southeast Region, 1995 – 2000

The third objective is to discuss the role of rural/urban differences in the *PINCGRO*. Differences in urban and rural, as well as coastal and non-coastal counties, played an important role towards the pattern of *PINCGRO*. Descriptive statistics for urban and rural differences and coastal and non-coastal differences in *PINCGRO* for 5 natural break classification schemes are reported in Table 4.2 and are visualized in Figure 4.5.

When the differences are compared for metropolitan, urban, and rural counties, real per capita personal income for metropolitan areas and urban counties with a population of 20,000 or more are higher than the overall average for the southeast region in each year over the period 1995 to 2000. Average per capita personal income from 1995 to 2000 for metropolitan counties is higher than the Southeast average by 18.24%; urban 4 & 5 counties (with a population of more than 20,000) are higher than the southeast regional average by 8.9%. Real per capita personal income for urban counties with populations between 2,500 and 19,999 (12.5% below the Southeast average) and rural counties (5.9% below the Southeast) is lower than the average of the southeast region in each of the six years examined.

The rural and urban differences in per capita personal income appear to be correlated with the differences in urban and rural socioeconomic phenomena such as labor force, employment, value of goods and services produced, total income generated, the standard of living, and age and racial composition of the population. Figure 4.6 illustrates the trend for real per capita personal income, which is increasing over time.

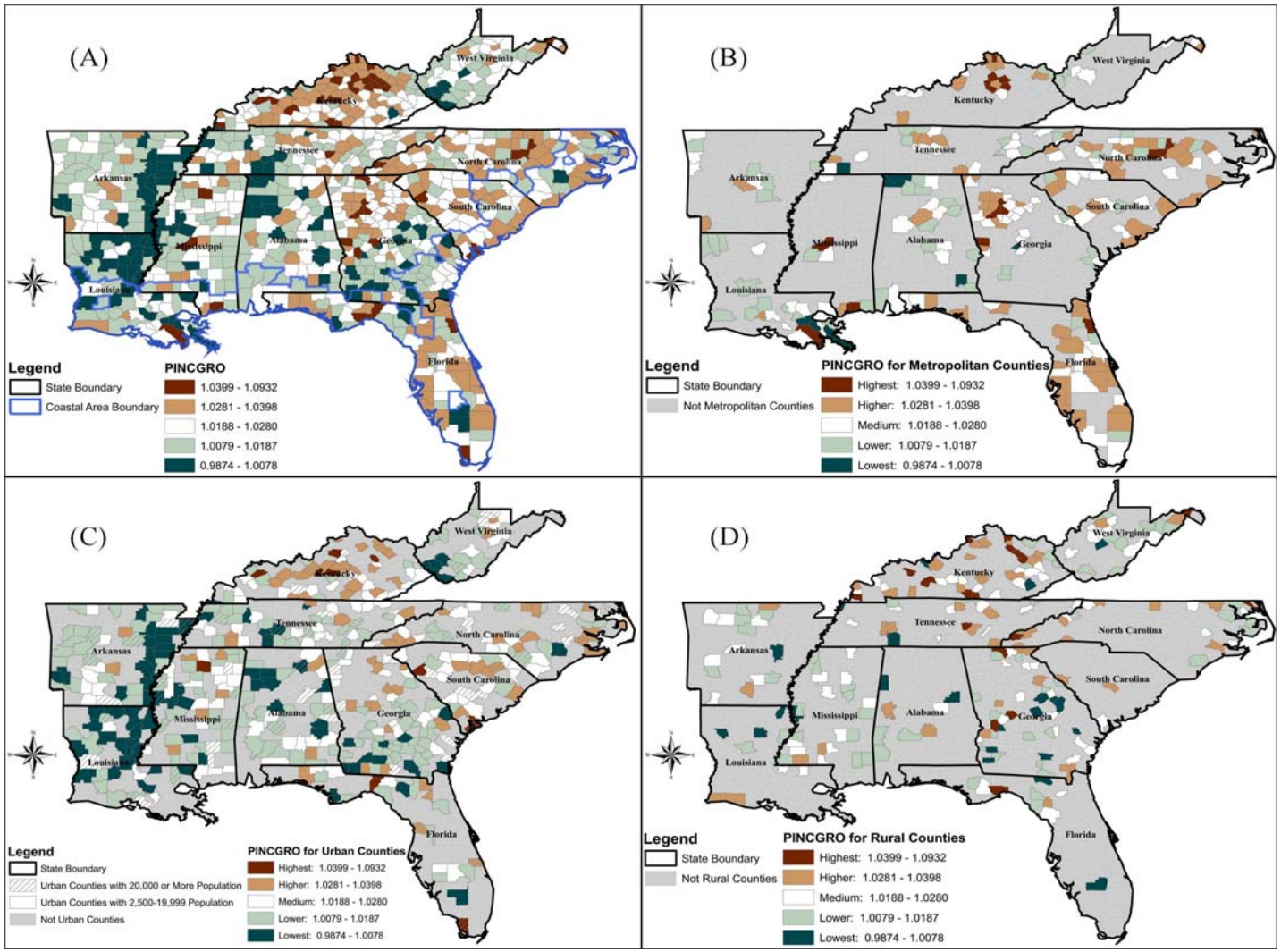


Figure 4.5 Coastal/Non-coastal and Rural/Urban Differences in the Average Annual Rate of Change in per Capita Personal Income for the Southeast, 1995 - 2000

Table 4.2 Descriptive Statistics for *PINCGRO*, by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC	No. of Counties	Mean	Std. Dev.
Southeast	Total	930	1.0213	0.0116
[0.9874 - 1.0932]	Metropolitan	250	1.0249	0.0096
	Urban 4 & 5	62	1.0199	0.0087
	Urban 6 & 7	397	1.0183	0.0110
	Rural 8 & 9	221	1.0230	0.0138
	Coastal	206	1.0218	0.0104
	Non-Coastal	724	1.0212	0.0119
Highest *PINCGRO*	Total	44	1.0475	0.0102
[1.0399 - 1.0932]	Metropolitan	16	1.0455	0.0052
	Urban 4 & 5	2	1.0413	0.0013
	Urban 6 & 7	8	1.0455	0.0058
	Rural 8 & 9	18	1.0508	0.0144
	Coastal	8	1.0434	0.0051
	Non-Coastal	36	1.0484	0.0109
Higher *PINCGRO*	Total	197	1.0326	0.0033
[1.0281 - 1.0398]	Metropolitan	77	1.0323	0.0034
	Urban 4 & 5	6	1.0309	0.0034
	Urban 6 & 7	68	1.0322	0.0029
	Rural 8 & 9	46	1.0341	0.0034
	Coastal	51	1.0324	0.0030
	Non-Coastal	146	1.0327	0.0034
Medium *PINCGRO*	Total	312	1.0234	0.0026
[1.0188 - 1.0280]	Metropolitan	89	1.0234	0.0027
	Urban 4 & 5	28	1.0229	0.0029
	Urban 6 & 7	122	1.0233	0.0026
	Rural 8 & 9	73	1.0238	0.0025
	Coastal	65	1.0237	0.0027
	Non-Coastal	247	1.0233	0.0026
Lower *PINCGRO*	Total	271	1.0141	0.0031
[1.0079 - 1.0187]	Metropolitan	59	1.0150	0.0029
	Urban 4 & 5	22	1.0150	0.0026
	Urban 6 & 7	129	1.0136	0.0032
	Rural 8 & 9	61	1.0140	0.0031
	Coastal	61	1.0145	0.0031
	Non-Coastal	210	1.0140	0.0031
Lowest *PINCGRO*	Total	106	1.0017	0.0050
[0.9874 - 1.0078]	Metropolitan	9	1.0051	0.0031
	Urban 4 & 5	4	0.9994	0.0061
	Urban 6 & 7	70	1.0019	0.0047
	Rural 8 & 9	23	1.0004	0.0056
	Coastal	21	1.0031	0.0042
	Non-Coastal	85	1.0014	0.0051

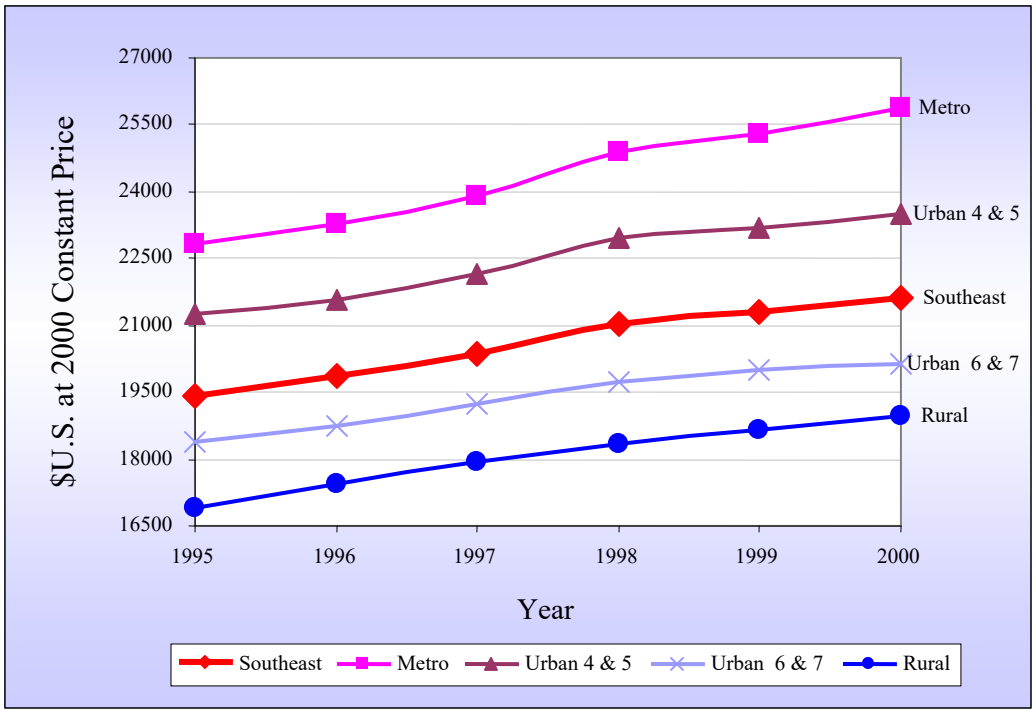


Figure 4.6 Rural and Urban Differences in the Average Real per Capita Personal Income in 2000 Constant Price, 1995 – 2000

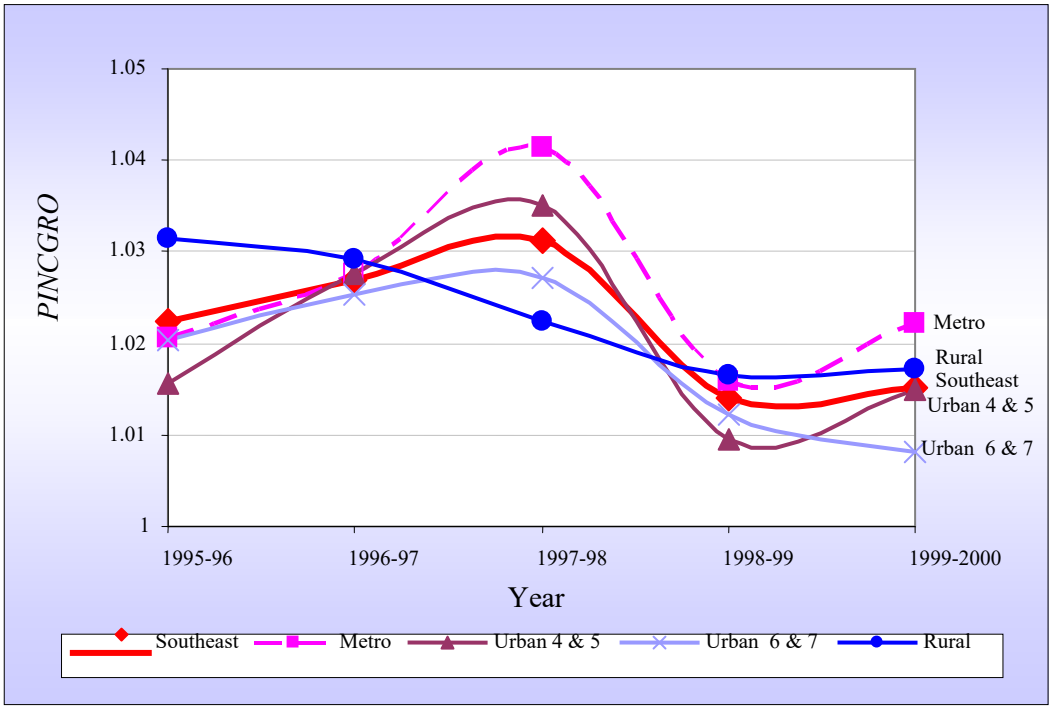


Figure 4.7 Rural and Urban Differences in the Annual Rate of Change in Real per Capita Personal Income, 1995 - 2000

The average annual rate of change in real personal income for metropolitan and rural counties is higher than the overall southeastern regional average, while the annual rate of change for urban counties is lower than the Southeastern regional average annual rate of change.

The average annual rate of change in real per capita personal income (*PINCGRO*) fluctuates during the study period (Figure 4.7). For metro and urban areas, *PINCGRO* parallels the southeast average. Although rural *PINCGRO* displays a downward overall trend for the study period, the rural *PINCGRO* rate is actually higher than the southeast average for the period 1995-2000 with the single exception of 1997 - 1998.

As shown in Table 4.1, real per capita personal income for each state and the southeast region increased annually during the study period. When compared to other states, on average from 1995 to 2000, the highest real per capita personal income states are Florida (13.6% above the southeast average) and North Carolina (11.6% above the Southeast average); the lowest real per capita personal income states are Mississippi (10.5% below the southeast average), West Virginia (8.6% below the southeast average) and Arkansas.

There are several characteristics that should be noted when examining differences in per capita personal income for Florida in comparison to the other southeastern states. Florida is one of the nine states that does not impose a personal income tax; however, the state does impose a tax on intangible personal prosperity (stocks, bonds, mutual funds, etc.). States that have high per capita income and high growth rates in real state income tax collections are possibly the result of tax amnesties (Dubin, Jeffrey A., Michael J. Graetz and Louis L. Wilde, 1992). Reasoning would be that an amnesty in such states is

expected to generate higher yield (Dubin, Jeffrey A., Michael J. Graetz and Louis L. Wilde, 1992).

Florida is located on a large peninsula between the Atlantic Ocean and the Gulf of Mexico. The state has warm weather, hundreds of miles of beautiful beaches, and world known amusements parks that attract millions of tourists each year. Therefore, one of Florida's main economic engines is tourism. In addition, according to floridahightech.com, Florida's highly advanced technical industries are growing; these industries require highly skilled labor which is adds to the high per capita income. Over 85% of the counties in Florida are metropolitan or urban counties with 2,500 or more of population; 50.7% were counties in the metropolitan areas. This produces a significant impact to the state and its economic growth.

Some contributing factors toward the high per capita personal income for North Carolina are the steady growth of information and biotechnology industries in the Research Triangle Park. Additionally, according to the N.C. Research and Education Network (NCREN) & Microelectronics Center of North Carolina (MCNC), local research universities, such as Duke University, University of North Carolina at Chapel Hill, University of North Carolina at Charlotte, and N.C. State University, also have an impact on the state's economic growth by MCNC helping North Carolina sustain its leadership in key industries, such as biotechnology, pharmaceuticals, and information technology. Similarly for other states, counties with large universities (more than 10,000 enrollments) have relatively higher per capita personal income.

Mississippi, West Virginia, and Arkansas have the lowest per capita personal income from 1995-2000, not only in the southeast region, but nationally. A possible

explanation for such low per capita personal income (mentioned above) is the reliance on low value-added industries, such as agriculture, forestry, forest product, and coal mining industries, rather than the high value-added industries characteristic of the high per capita income states. Employment in low value-added industries tends to be characterized by low educational attainment. Employment in high value-added industries, such as informational technology, engineering, finance/business, education, and health are generally characterized by a high educational attainment and/or high skilled workers. During the 19th and 20th century, the continuing growth in per capita income [over-time across countries and regions] has been highly correlated with technological advancements, scientific knowledge, education, school enrollment, skills, and experience (Becker, Gary S., Kevin M. Murphy and Robert Tamura, 1990, Feldman, Maryann, 2000, Krugman, Paul, 1991a, b, Lucas, Robert E. , 1993, Romer, Paul M., 1990). At the county level in Mississippi and West Virginia, high *PINCGRO* counties are counties with large universities (over 10,000 student enrollment).

The states with the highest average annual rates of change in personal income during the study period include Kentucky (3.05%), South Carolina (2.65%), and North Carolina (2.59%). States with the lowest average annual rates of change in personal income include Louisiana (1.14%), Alabama (1.49%), and Arkansas (1.53%).

Kentucky has a particularly interesting development with respect to per capita personal income growth. When compared to the rest of the nation, per capita personal income for Kentucky has historically been far below the national average, usually between 41st and 43rd in the nation between 1995 to 2000 (U.S. Bureau of Economic Analysis, 2006). Figure 4.4 illustrates that the geographic source of much of Kentucky's

per capita personal income growth is centered between Interstates 64, 65, and 75, because most of the population is located in this area (see Figure 4.23); this illustrates the interdependence relationship. However, from 1995 to 2000, Kentucky's per capita personal income increased dramatically when compared to the rest of the southeastern states. The reason for Kentucky's significant growth from 1995 to 2000 is that the automobile manufacturing industry developed a very strong presence in Kentucky (U.S. Bureau of Economic Analysis, 2006). The automobile manufacturing industry has provided thousands of well-paying jobs to the people of Kentucky. Additionally, some surveys and reports have Kentucky as one of the ideal places to live. According to the North American Business Cost Review, 10th Edition, Kentucky had the lowest overall cost of doing business when compared to the top ten auto producing states. Moreover, Kentucky's personal income by motor vehicles and equipment has grown from $1,701,998,000 in 1995 to $2,914,545,000 in 2005, or over 71% in five years for an average growth of 15% a year (U.S. Bureau of Economic Analysis, 2006). This may be a positive significant factor which has helped Kentucky's economic presence and growth in the southeastern states.

4.1.2 Number of People Employed

This section discusses the main statistical and spatial features of data for the number of people employed and its average annual rate of change from 1995 to 2000 (*EMPGRO*). The role of differences in urban/rural and coastal/non-coastal counties in *EMPGRO* is examined.

The average of the total number of people employed per county and its average annual rate of change from 1995 to 2000 are reported in Table 4.3. Figure 4.8 illustrates an average annual rate of change in the total number of people employed from 1995 to 2000 (*EMPGRO*) at the county level. Figure 4.9 demonstrates the geographic distribution of the average annual rate of change in the total number of people employed from 1995 to 2000.

Table 4.3 The Average of the Total Number of People Employed per County and Its Average Annual Rate of Change, 1995 - 2000

RUC/Coastal /States	No. of Counties	Average of the Total Number of People Employed per County						*EMPGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	28702	29347	30023	30569	31085	31539	1.0153
Metro	250	77007	79088	81236	83172	84864	85733	1.0234
Urban 4 & 5	62	30906	31350	31836	31997	32161	32437	1.0077
Urban 6 & 7	397	11449	11550	11673	11703	11785	12117	1.0096
Rural	221	4433	4488	4543	4555	4616	4871	1.0184
Coastal	206	50012	51261	52758	53941	55003	55721	1.0191
Non-Coastal	724	22638	23112	23554	23920	24280	24658	1.0142
Alabama	67	29192	29741	30375	30736	30899	30938	1.0087
Arkansas	75	15608	15720	15695	15725	15974	16046	1.0043
Florida	67	99336	101896	105085	107946	110473	112816	1.0276
Georgia	159	22157	22882	23596	24287	24853	25686	1.0246
Kentucky	120	14643	14811	15082	15273	15452	15590	1.0127
Louisiana	64	28443	28992	29533	29983	30105	30115	1.0095
Mississippi	82	14333	14476	14645	14775	14923	15170	1.0119
North Carolina	100	35827	37041	38096	38448	39212	39594	1.0157
South Carolina	46	38144	38818	39555	40197	40802	41215	1.0118
Tennessee	95	27095	27484	27790	28265	28654	28944	1.0150
West Virginia	55	13162	13377	13572	13721	13862	13910	1.0164

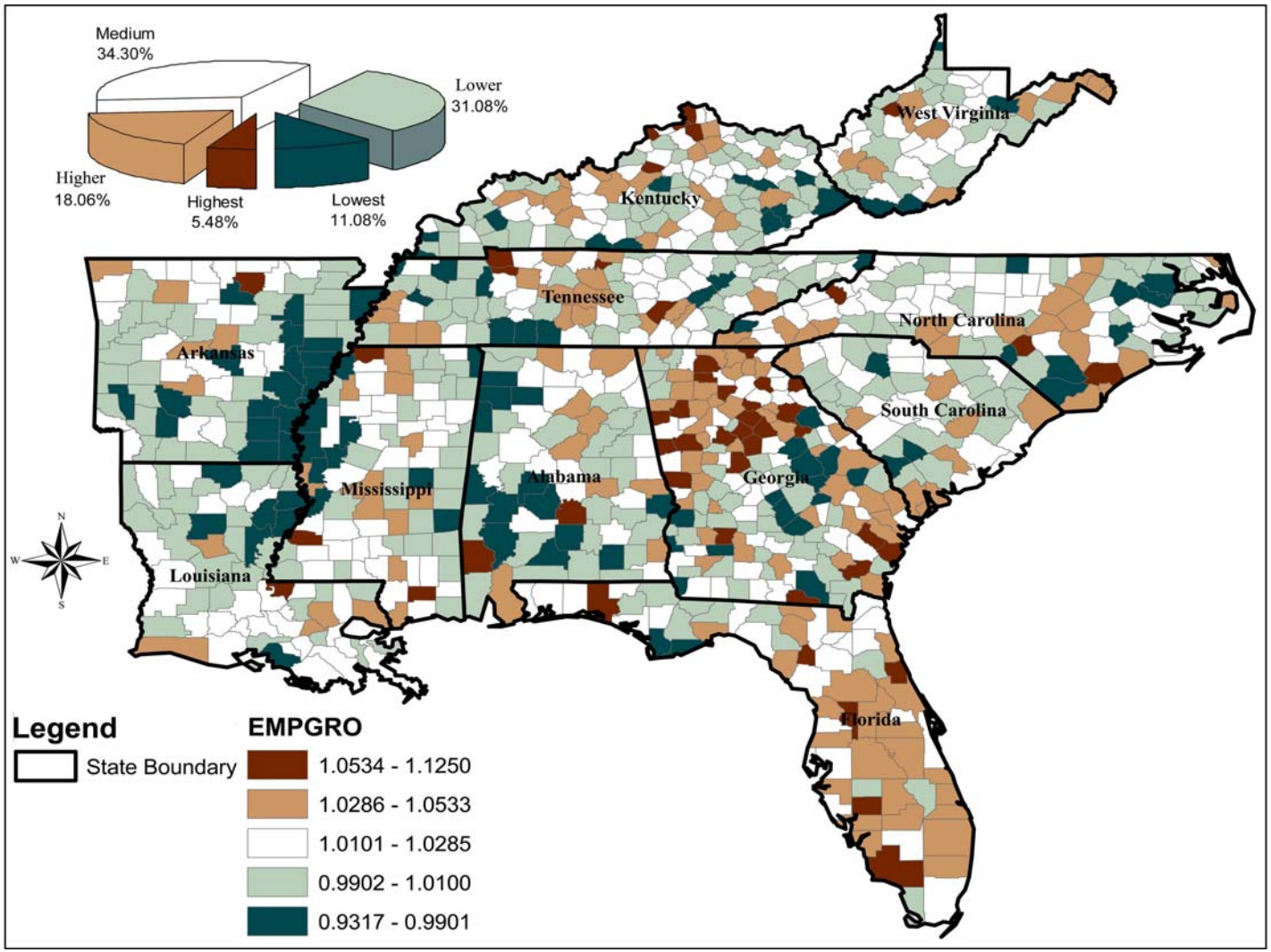


Figure 4.8 The Average Annual Rate of Change in the Total Number of People Employed for the Southeast Region, 1995 – 2000

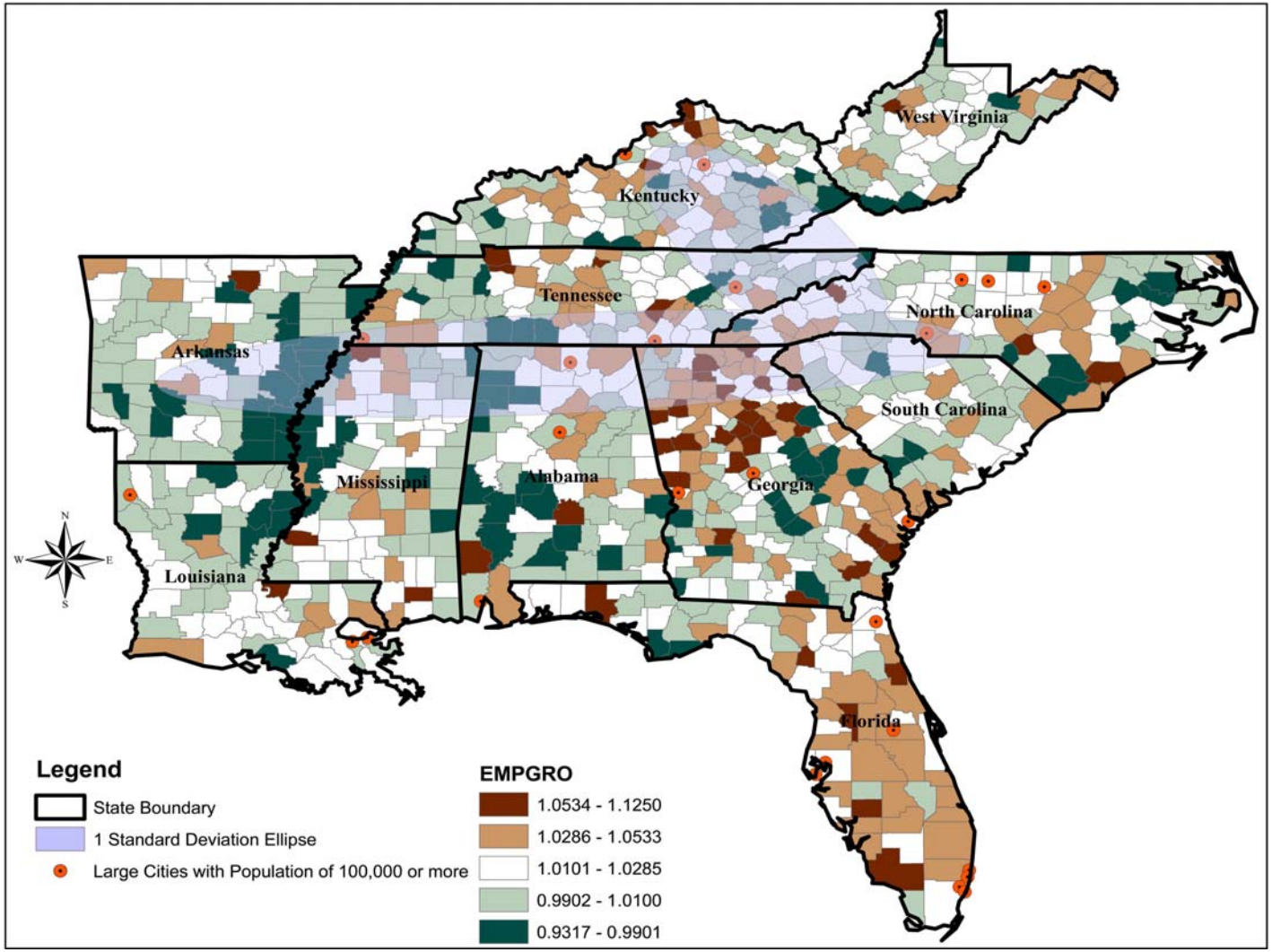


Figure 4.9 Spatial Distribution of the Average Annual Rate of Change in the Total Number of People Employed for the Southeast Region, 1995 – 2000

Shown in Table 4.3, the Southeast region's average of the total number of people employed per county increased from 28,702 to 31,539, or 9.9% from 1995 to 2000. The average annual rate of change (*EMPGRO)* in the total number of people per county for the southeast region is 1.0153, which means that on average, the total number of people employed increased by 1.53% annually from 1995 to 2000. The range of *EMPGRO* is from 0.9317 (-6.83%) to 1.1250 (12.50%). Average annual rate of change in number of people employed higher than average annual rate of change in population density. The average annual rate of change in the total number of people employed is classified into 5 classes using the natural break classification schemes illustrated in Figure 4.7. From a total of 930 counties in the Southeast, 23.54% are in the high *EMPGRO* counties (5.48% - highest *EMPGRO* and 18.06% - higher *EMPGRO*), 34.30% fit in the medium *EMPGRO* counties, and 42.16% belong to the low *EMPGRO* counties (31.08% - lower *EMPGRO* and 11.08% - lowest *EMPGRO*).

Figure 4.8 and Figure 4.9 are visualizations that provide identification of employment cluster locations. The eastern part (northern Georgia, the coastal area of Georgia, the Durham areas in North Carolina, the coastal areas of North Carolina) and the western part (most areas of Arkansas, Alabama, Louisiana, western and southeastern Mississippi, southern Georgia, and western Tennessee) contained large cold spots. Additional explicit analysis geared at analyzing clusters is expanded in Chapter 5. In Figure 4.8, there are spatial trends that follow the "three states border line" and/or large cities with a population of 100,000 or more. When examined carefully, following the trend lines from the west to south, the average annual rate of change in the total number of people employed increase.

From 1995 to 2000, Florida had, on average, the highest number of people employed, while West Virginia had the lowest number of people employed. This pattern is consistent with a number of theoretical findings about classic urban issues, such as the interdependency between cities and metropolitan areas (Kain, John F., and Neidercorn, John H., 1963), the role of transport cost (Hoover 1937), and input price differences (Carlton 1983) (Glaeser, Edward L., 2000). Models of labor market pooling or the division of labor emphasize the role of cities in facilitating the movement of people. (Glaeser, Edward L., 2000) According to the new economic growth theory, agglomeration is the main force geared toward urban and regional growth. Agglomeration effects usually result in workers and firms crowding together. This results in lower transportation costs, greater economies of scale, and easier sharing of information. Agglomeration also allows quicker generation and spread of new ideas. Cities that produce more ideas will grow because innovators may be geographically fixed during the early period of innovation. Location within well-defined regions becomes a factor that induces the initiation of technological modifications and favors the generation of technological knowledge in highly productive surroundings. (Antonelli, Cristiano, 2000) The average annual rate of change in the total number of people employed is highest in counties located in the metropolitan areas. The urban benefit of reducing transport costs for goods is evident in the classic manufacturing cities of the nineteenth century and is formalized in Krugman (1991); however, this advantage is decomposing over time as transport costs fall and as manufacturing moves away from the city. (Glaeser, Edward L., 2000) This is likely the reason that *PINCGRO* is not as high in counties with large cities as it is in neighboring counties with similar large cities that are

part of metropolitan areas. Florida has the highest number of large cities with populations of more than 100,000; West Virginia does not have any cities with a population of more than 100,000 in this study time frame.

Rural counties have a high average annual rate of change in the total number of people employed per county but also have the lowest level of real per capita income (Figure 4.6). The latter may be the cause of the former. That is, the low real per capita level of personal income may be a major attraction for employers seeking low wage labor. Differences in urban and rural, as well as coastal and non-coastal counties are evident in the pattern of the average annual rate of change in the total number of people employed. The coastal counties tend to have more counties in metropolitan areas or urban counties and have higher employment growth. Figure 4.9 illustrates the average annual rate of change in the total number of people employed by coastal and non-coastal counties, counties in metropolitan areas, urban counties, and rural counties respectively. Table 4.4 provides the rural and urban, as well as coastal and non-coastal differences, in *EMPGRO* by 5 natural break classes.

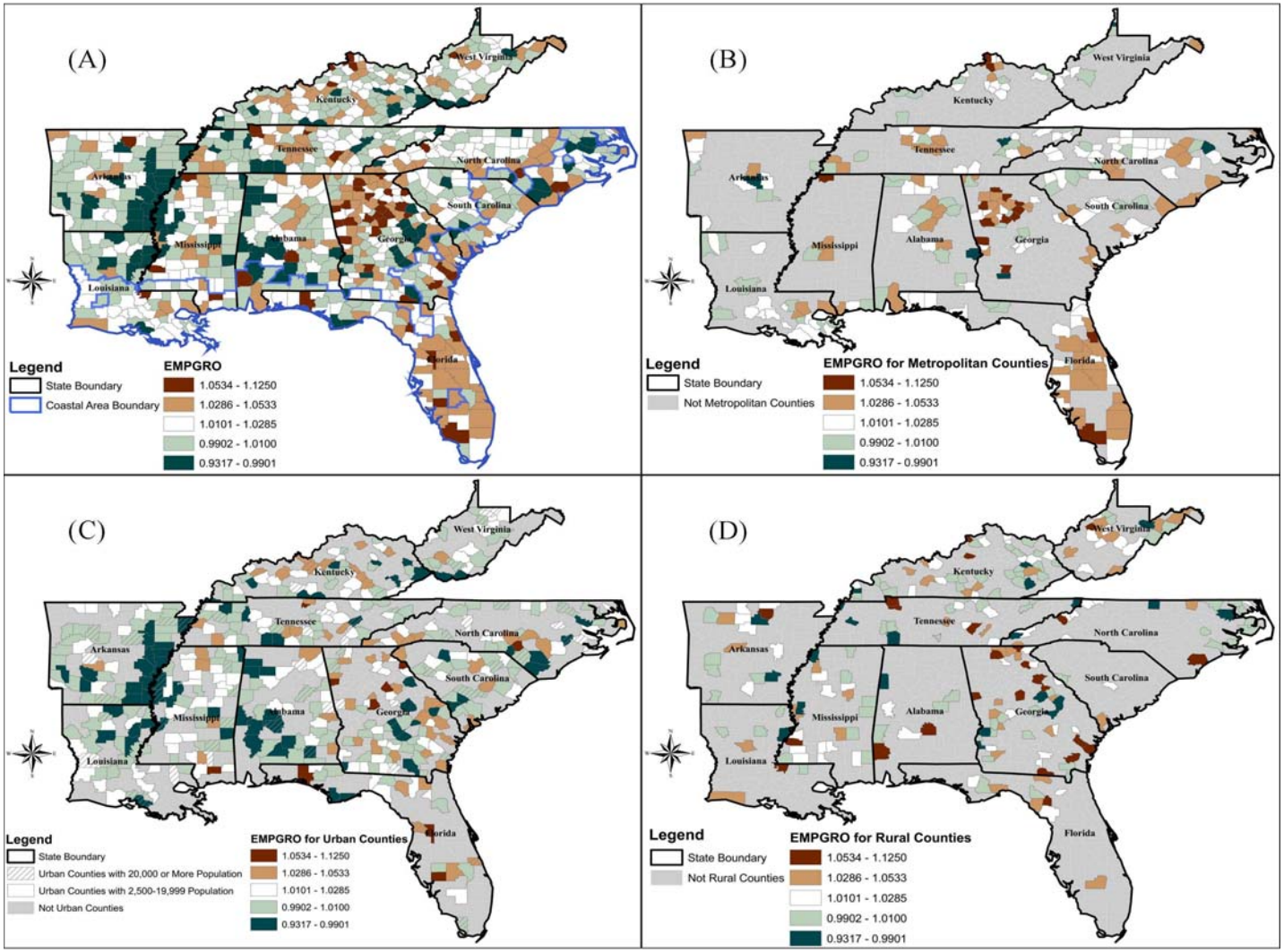


Figure 4.10 Coastal/Non-Coastal and Rural/Urban Differences in the Average Annual Rate of Change in the Total Number of People Employed for the Southeast, 1995 - 2000

Table 4.4 Descriptive Statistics for *EMPGRO*, by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC	No. of Counties	Mean	Std. Dev.
Southeast	Total	930	1.0153	0.0228
[0.9317 - 1.1250]	Metropolitan	250	1.0234	0.0193
	Urban 4 & 5	62	1.0077	0.0176
	Urban 6 & 7	397	1.0096	0.0213
	Rural 8 & 9	221	1.0184	0.0266
	Coastal	206	1.0191	0.0212
	Non-Coastal	724	1.0142	0.0231
Highest *EMPGRO*	Total	51	1.0689	0.0155
[1.0534 - 1.1250]	Metropolitan	16	1.0691	0.0148
	Urban 4 & 5	0	-	-
	Urban 6 & 7	10	1.0672	0.0147
	Rural 8 & 9	25	1.0695	0.0167
	Coastal	13	1.0638	0.0087
	Non-Coastal	38	1.0707	0.0169
Higher *EMPGRO*	Total	168	1.0386	0.0065
[1.0286 - 1.0533]	Metropolitan	68	1.0390	0.0065
	Urban 4 & 5	6	1.0449	0.0069
	Urban 6 & 7	54	1.0371	0.0060
	Rural 8 & 9	40	1.0389	0.0068
	Coastal	48	1.0401	0.0067
	Non-Coastal	120	1.0380	0.0064
Medium *EMPGRO*	Total	319	1.0187	0.0054
[1.0101 - 1.0285]	Metropolitan	106	1.0190	0.0050
	Urban 4 & 5	18	1.0174	0.0048
	Urban 6 & 7	133	1.0185	0.0058
	Rural 8 & 9	62	1.0191	0.0055
	Coastal	71	1.0179	0.0056
	Non-Coastal	248	1.0189	0.0054
Lower *EMPGRO*	Total	289	1.0014	0.0056
[0.9902 - 1.0100]	Metropolitan	54	1.0029	0.0052
	Urban 4 & 5	29	1.0022	0.0054
	Urban 6 & 7	134	1.0008	0.0056
	Rural 8 & 9	72	1.0013	0.0060
	Coastal	61	1.0031	0.0049
	Non-Coastal	228	1.0010	0.0057
Lowest *EMPGRO*	Total	103	0.9790	0.0107
[0.9317 - 0.9901]	Metropolitan	6	0.9875	0.0010
	Urban 4 & 5	9	0.9815	0.0066
	Urban 6 & 7	66	0.9784	0.0110
	Rural 8 & 9	22	0.9773	0.0117
	Coastal	13	0.9784	0.0091
	Non-Coastal	90	0.9791	0.0109

Illustrated in Table 4.4 and Figure 4.10, for the Southeast from 1995 to 2000, *EMPGRO* in coastal is slightly higher than *EMPGRO* in non-coastal counties. Although 21.82% of non-coastal counties (5.25% - highest *EMPGRO*, 16.57% - higher *EMPGRO*) and 29.61% of coastal counties (6.31% - highest *EMPGRO*, 23.30% - higher *EMPGRO*) are in the high *EMPGRO* class; *EMPGRO* rate for non-coastal counties is slightly higher than coastal counties in the highest *EMPGRO* class; it is almost the same as in higher *EMPGRO* class. Included in the low *EMPGRO* class are 43.92% (31.49% - lower *EMPGRO*, 12.43% - lowest *EMPGRO*) non-coastal counties and 35.92% (29.61% - lower *EMPGRO*, 6.31% - lowest *EMPGRO*) coastal counties. *EMPGRO* rates for coastal counties are higher than non-coastal counties in the lower *EMPGRO* class and almost the same as in lowest *EMPGRO* class.

Table 4.4 and Figure 4.10 illustrate the *EMPGRO* characteristics. Counties with an urban population below 20,000 (counties belong to Urban 6 & 7, Rural 8 & 9 categories) have the largest share of high *EMPGRO* counties. Urban 6 & 7 counties are 64.08% of the lowest *EMPGRO* counties and 46.37% of the lower *EMPGRO* counties; rural counties with 21.36% and 24.91% follow this respectively. In the low *EMPGRO* counties class, 24.00% of the metropolitan counties, 61.29% of the urban 4 &5 counties, 50.37% of urban 6 & 7 counties, and 42.53% of rural counties are included.

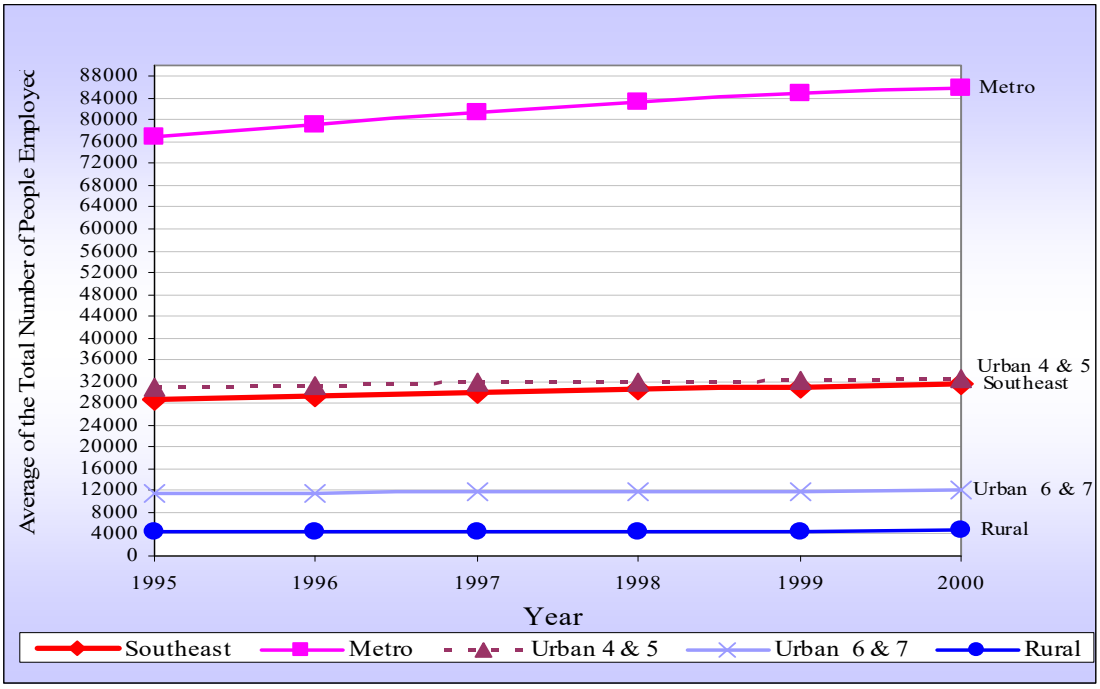


Figure 4.11 Rural and Urban Differences in the Average of the Total Number of People Employed per County for the Southeast Region, 1995 – 2000

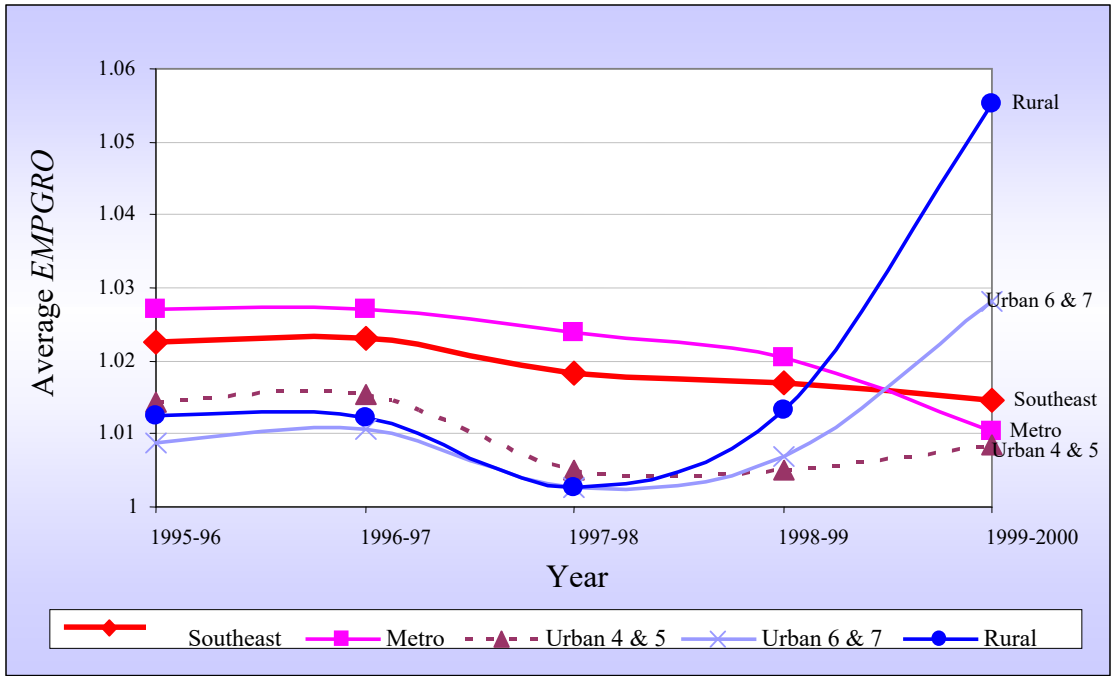


Figure 4.12 Rural and Urban Differences in the Annual Rate of Change in the Total Number of People Employed, 1995 - 2000

Figure 4.11 demonstrates the average of the total number of people employed per county that illustrates the slight increase in the southeast region from year to year. For counties located in the metropolitan areas, the number of employed people is much higher than for urban and rural counties. When counties exhibit more rural characteristics and low population, the job opportunities tend to decline. Although urban counties with a population of 20,000 or more are only 6.67% of the total southeast counties, on average, these counties have a greater number of people employed than the average of the Southeast.

Figure 4.12 illustrates the annual rate of change in the total number of people employed for rural counties and urban counties with a population between 2,500 and 19,999, which had increased dramatically from 1997 to 2000. In contrast, the annual rate of change in the total number of people employed for metropolitan counties declined over the period. From a theoretical view, as transport costs decline, manufacturing leaves the city in search of lower labor costs to increase profit maximization.

4.1.3 Total Number of Establishments

The average of the total number of establishments per county and its average annual rate of change from 1995 to 2000 are reported in Table 4.5. Figure 4.13 illustrates the average annual rate of change in the total number of establishments from 1995 to 2000 (*ESTGRO*) at the county level. From Table 4.5, on average, the southeast region average for the total number of establishments per county increased by 7.7% (from 1513 to 1629) from 1995 to 2000.

Table 4.5 The Average of the Total Number of Establishments per County and Its Average Annual Rate of Change, 1995 - 2000

RUC/Coastal /States	No. of Counties	Average of the Total Number of Establishments						*ESTGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	1513	1549	1596	1606	1620	1629	1.0121
Metro	250	4202	4306	4444	4477	4524	4561	1.0229
Urban 4 & 5	62	1659	1693	1736	1747	1755	1753	1.0100
Urban 6 & 7	397	538	551	563	564	565	564	1.0072
Rural	221	180	185	189	190	191	190	1.0091
Coastal	206	2866	2937	3018	3039	3064	3086	1.0172
Non-Coastal	724	1128	1155	1191	1198	1209	1214	1.0146
Alabama	67	1433	1465	1496	1497	1500	1489	1.0056
Arkansas	75	803	817	831	831	836	842	1.0061
Florida	67	5943	6079	6231	6278	6329	6393	1.0147
Georgia	159	1126	1159	1203	1221	1244	1260	1.0220
Kentucky	120	709	724	742	746	749	749	1.0098
Louisiana	64	1499	1533	1573	1571	1577	1575	1.0095
Mississippi	82	696	708	723	728	729	728	1.0057
North Carolina	100	1820	1879	1975	1987	2017	2039	1.0188
South Carolina	46	1912	1963	2041	2064	2096	2111	1.0144
Tennessee	95	1314	1343	1378	1380	1380	1377	1.0109
West Virginia	55	738	746	756	758	753	746	1.0008

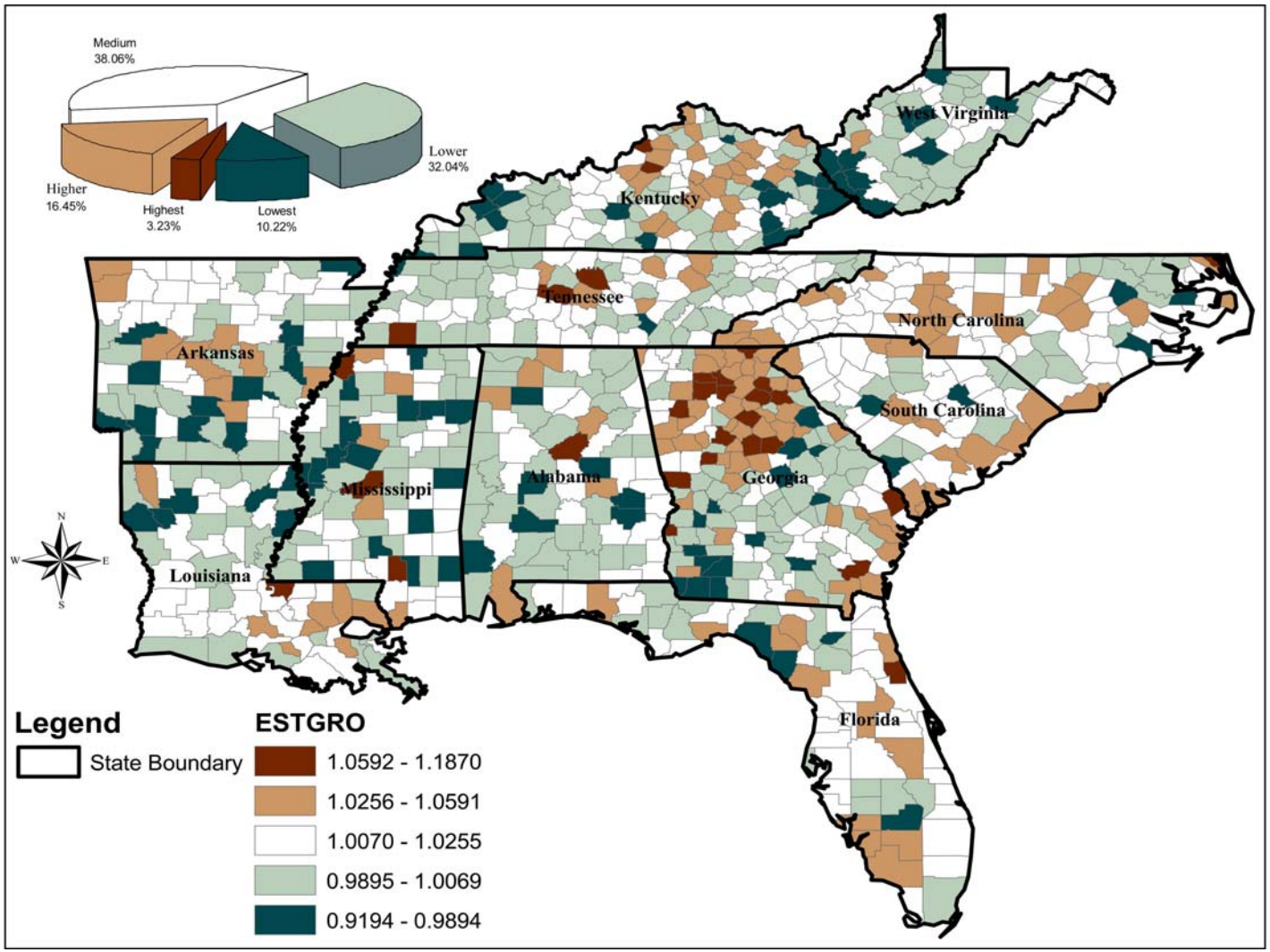


Figure 4.13 The Average Annual Rate of Change in the Total Number of Establishments for the Southeast Region, 1995 – 2000

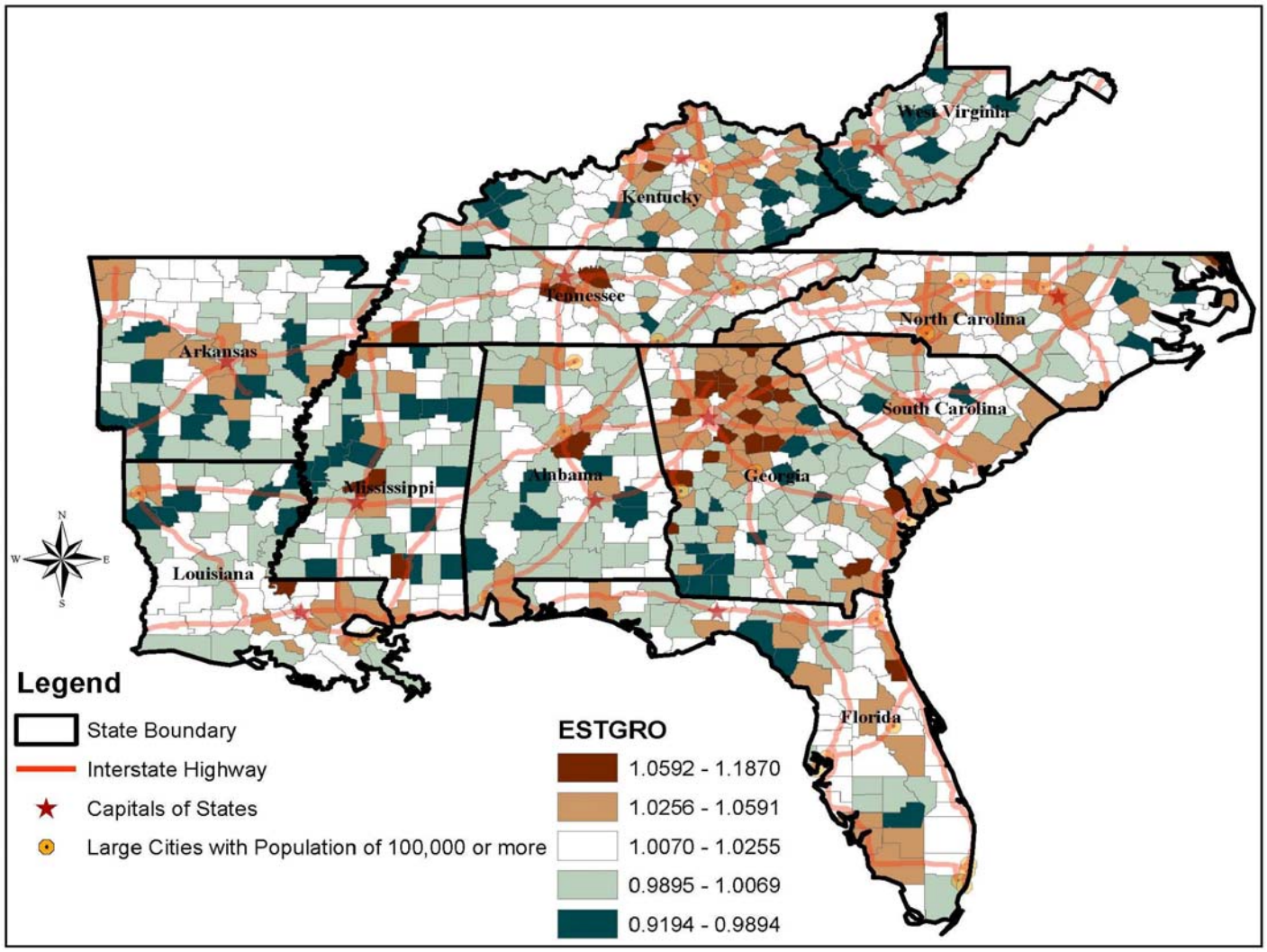


Figure 4.14 Spatial Distribution of the Average Annual Rate of Change in the Total Number of Establishments for the Southeast Region, 1995 – 2000

The average annual rate of change in the total number of establishments per county for the southeast region is 1.0121, which means, on average, the total number of establishments increased by 1.21% annually from 1995 to 2000, as shown in Table 4.5 The range of *ESTGRO* is 0.9194 (-8.06%) to 1.1870 (18.70%). On average, the total number of establishments of the county for metropolitan areas is about 23.6 times the total number of establishments in rural counties, 8 times larger than the total number of establishments in urban counties with an urban population between 2,500 and 19,999, and 2.6 times the total number of establishments in urban counties with an urban population of 20,000. The average annual rate of change in the total number of establishments is classified into 5 classes using the natural break classification schemes illustrated in Figure 4.13.

Figure 4.13 provides initial visualization of establishment cluster locations. The northern and coastal area of Georgia, northeastern Kentucky, central North Carolina, and coastal areas of South Carolina have high *ESTGRO*; the western and central parts of the Southeast have low *ESTGRO*. Additional explicit analyses are provided in Chapter 5.

There does not appear to be any significant spatial trend for *ESTGRO*; therefore, a one standard deviation directional distribution ellipse cannot be built. However, in Figure 4.14, it is shown that interstates appear to play a role in the growth of the number of establishments when manufacturers leave the large cities. Suburban counties in metropolitan areas (excluding counties with large cities), or completely rural areas are the locations where manufacturers have shown interest when wanting to build establishments.

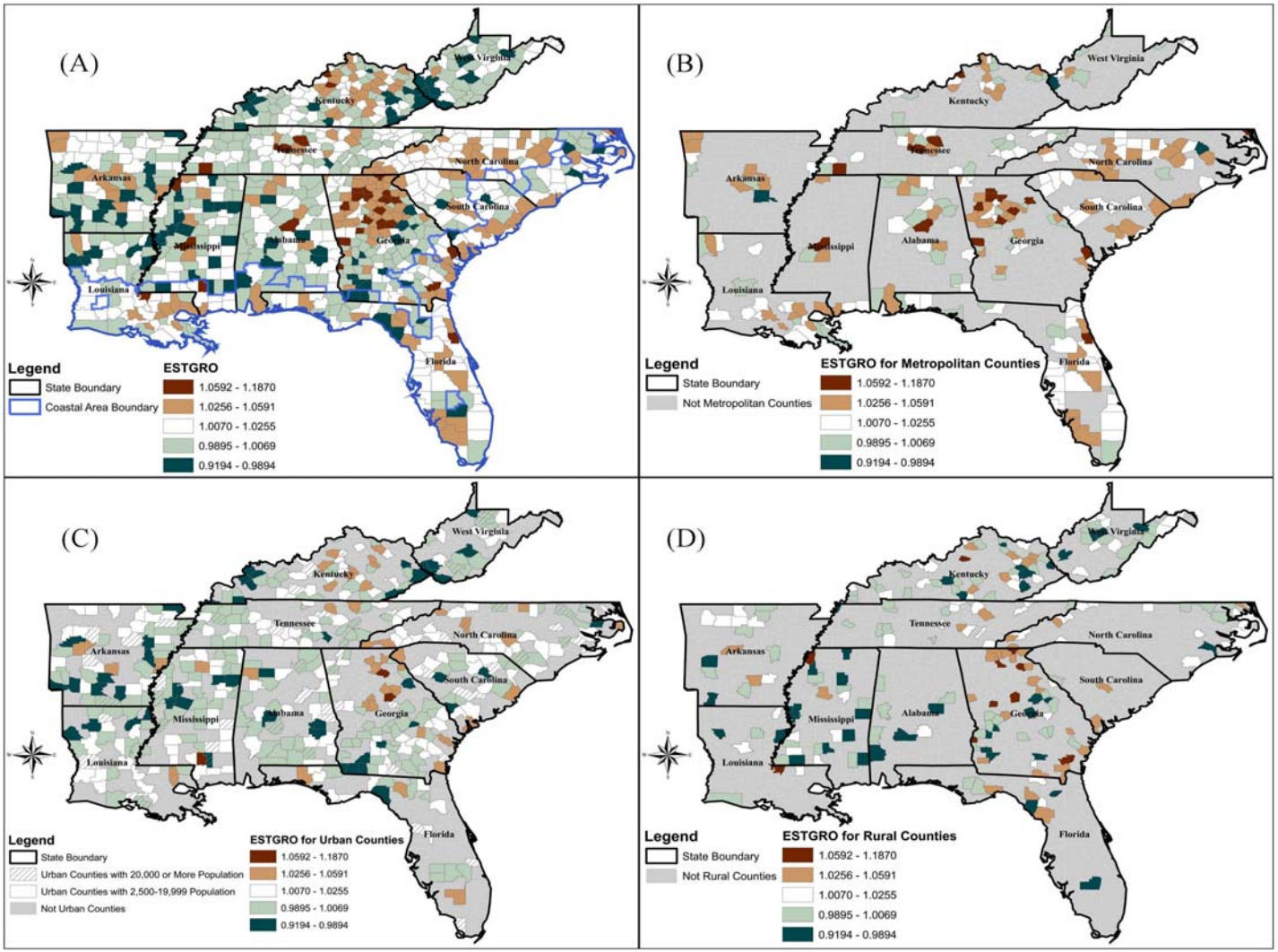


Figure 4.15 Coastal/Non-Coastal and Rural/Urban Differences in the Average Annual Rate of Change in the Total Number of Establishments for the Southeast, 1995 - 2000

Table 4.6 Descriptive Statistics for *ESTGRO*, by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC	No. of Counties	Mean	Std. Dev.
Southeast	Total	930	1.0121	0.0220
[0.9194 - 1.1870]	Metropolitan	250	1.0229	0.0227
	Urban 4 & 5	62	1.0100	0.0099
	Urban 6 & 7	397	1.0072	0.0165
	Rural 8 & 9	221	1.0091	0.0276
	Coastal	206	1.0152	0.0200
	Non-Coastal	724	1.0112	0.0225
Highest *ESTGRO*	Total	30	1.0822	0.0265
[1.0592 - 1.1870]	Metropolitan	17	1.0802	0.0187
	Urban 4 & 5	0	-	-
	Urban 6 & 7	3	1.0870	0.0300
	Rural 8 & 9	10	1.0841	0.0377
	Coastal	6	1.0776	0.0219
	Non-Coastal	24	1.0833	0.0278
Higher *ESTGRO*	Total	153	1.0368	0.0085
[1.0256 - 1.0591]	Metropolitan	76	1.0377	0.0090
	Urban 4 & 5	4	1.0356	0.0097
	Urban 6 & 7	38	1.0342	0.0074
	Rural 8 & 9	35	1.0378	0.0083
	Coastal	37	1.0371	0.0085
	Non-Coastal	116	1.0367	0.0086
Medium *ESTGRO*	Total	354	1.0147	0.0051
[1.0070 - 1.0255]	Metropolitan	97	1.0159	0.0052
	Urban 4 & 5	34	1.0130	0.0037
	Urban 6 & 7	159	1.0145	0.0051
	Rural 8 & 9	64	1.0145	0.0054
	Coastal	102	1.0151	0.0055
	Non-Coastal	252	1.0146	0.0050
Lower *ESTGRO*	Total	298	0.9994	0.0047
[0.9895- 1.0069]	Metropolitan	56	1.0005	0.0043
	Urban 4 & 5	23	1.0020	0.0044
	Urban 6 & 7	148	0.9991	0.0046
	Rural 8 & 9	71	0.9986	0.0049
	Coastal	48	1.0007	0.0045
	Non-Coastal	250	0.9992	0.0047
Lowest *ESTGRO*	Total	95	0.9797	0.0113
[0.9194 - 0.9894]	Metropolitan	4	0.9822	0.0128
	Urban 4 & 5	1	0.9886	-
	Urban 6 & 7	49	0.9825	0.0063
	Rural 8 & 9	41	0.9758	0.0146
	Coastal	13	0.9788	0.0191
	Non-Coastal	82	0.9798	0.0097

From a total of 930 counties in the Southeast, 19.68% are high *ESTGRO* counties (3.23% - highest *ESTGRO* and 16.45% - higher *ESTGRO*), 38.06% fit in the medium *ESTGRO* counties, and 42.26% belong to the low *ESTGRO* counties (32.04% - lower *ESTGRO*, 10.22% - lowest *ESTGRO*). Counties located in the metropolitan areas have the largest share of the highest and higher *ESTGRO* classes. Counties with an urban population below 20,000 constitute 43.33% (10.00% - urban 4 & 5 counties, 33.33% - rural counties) of the highest *ESTGRO* counties and 47.66% (24.84% - urban 4 & 5 counties, 22.88% - rural counties) of the higher *ESTGRO* counties. High *ESTGRO* counties include 37.2% of metropolitan counties, 6.45% of urban counties with a population of more than 20,000, 10.33% of urban counties with a population between 2,500 and 19,999, and 20.36% of rural counties. Urban counties with an urban population between 2,500 and 19,999 include 51.58% of the lowest *ESTGRO* counties and 49.66% of lower *ESTGRO* counties. Urban counties with a population of more than 20,000, include 43.16% of low *ESTGRO* counties, while rural counties make up 23.83%of this class.

For the Southeast from 1995 to 2000, *ESTGRO* in coastal counties is slightly higher than *ESTGRO* in non-coastal counties. Although 19.33% of non-coastal counties (3.31% - highest *ESTGRO*, 16.02% - higher *ESTGRO*) and 20.87% of coastal counties (2.91% - highest *ESTGRO*, 17.96% - higher *ESTGRO*) are in the high *ESTGRO* class, *ESTGRO* rate for non-coastal counties is slightly higher than coastal counties in the highest *ESTGRO* class. It is almost the same as in higher *ESTGRO* class. Low *ESTGRO* class includes 45.86% (34.53% - lower *ESTGRO*, 11.33% - lowest *ESTGRO*) of non-coastal counties and 29.61% (23.30% - lower *ESTGRO*, 6.31% - lowest *ESTGRO*) of

coastal counties. *ESTGRO* rate for coastal counties was higher than non-coastal counties in the lower *ESTGRO* class and almost the same for the lowest *ESTGRO* class.

On average, each county for the Southeast has about 88.7% small sized establishments, 9.3% are medium sized establishments, and 2.0% are large sized establishments spanning a period of 6 years from 1995 to 2000. Approximately 90.7% of the total numbers of establishments are small sized, 7.7% were medium sized, and 1.6% are large sized establishments in the rural counties.

4.1.3.1 Total Number of Small Sized Establishments

The average of the total number of small sized establishments per county and its average annual rate of change from 1995 to 2000 are reported in Table 4.7. Figure 4.16 illustrates the average annual rate of change in the total number of small sized establishments from 1995 to 2000 (*SESTGRO*) at the county level. From Table 4.7, on average, the southeast region average for the total number of small establishments per county increased by 6.7% (from 1313 to 1402) from 1995 to 2000. The average annual rate of change in the total number of small sized establishments per county for the southeast region is 1.0107, which means that, on average, the total number of small sized establishments increased by 1.07% annually from 1995 to 2000. The range of *SESTGRO* was 0.9059 (-9.41%) to 1.1864 (18.64%).

Table 4.7 The Average of the Total Number of Small Sized Establishments per County and Its Average Annual Rate of Change, 1995 - 2000

RUC/Coastal /States	No. of Counties	Average of the Total Number of Small Sized Establishments						*SESTGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	1313	1345	1385	1390	1399	1402	1.0107
Metro	250	3625	3713	3830	3848	3879	3900	1.0206
Urban 4 & 5	62	1444	1473	1509	1514	1519	1510	1.0080
Urban 6 & 7	397	477	489	500	500	500	497	1.0062
Rural	221	163	168	172	173	173	172	1.0085
Coastal	206	2520	2582	2653	2665	2684	2697	1.0138
Non-Coastal	724	970	993	1024	1027	1033	1034	1.0098
Alabama	67	1235	1262	1288	1286	1285	1274	1.0053
Arkansas	75	703	715	727	724	728	730	1.0045
Florida	67	5255	5377	5512	5543	5582	5629	1.0144
Georgia	159	965	994	1031	1045	1062	1072	1.0203
Kentucky	120	607	621	635	638	638	634	1.0081
Louisiana	64	1287	1315	1350	1340	1346	1342	1.0091
Mississippi	82	608	618	630	633	633	630	1.0041
North Carolina	100	1567	1619	1702	1707	1727	1740	1.0177
South Carolina	46	1663	1704	1768	1783	1806	1810	1.0120
Tennessee	95	1119	1144	1172	1168	1164	1156	1.0096
West Virginia	55	649	657	662	664	659	650	0.9994

From a total of 930 counties in the Southeast, 17.96% are in the high *SESTGRO* counties (2.80% - highest *SESTGRO* and 15.16% - higher *SESTGRO*), 37.85% fit in the medium *SESTGRO* counties, and 44.19% belong to the low *SESTGRO* counties (35.59% - lower *SESTGRO*, 8.60% - lowest *SESTGRO*). From 1995 to 2000, the fastest growing areas of small sized establishments are counties in the metropolitan areas (2.06% average annual rate of change in the average of the total number of small sized establishments (*SESTGRO*)), which are pursued by rural counties (0.85% - *SESTGRO*).

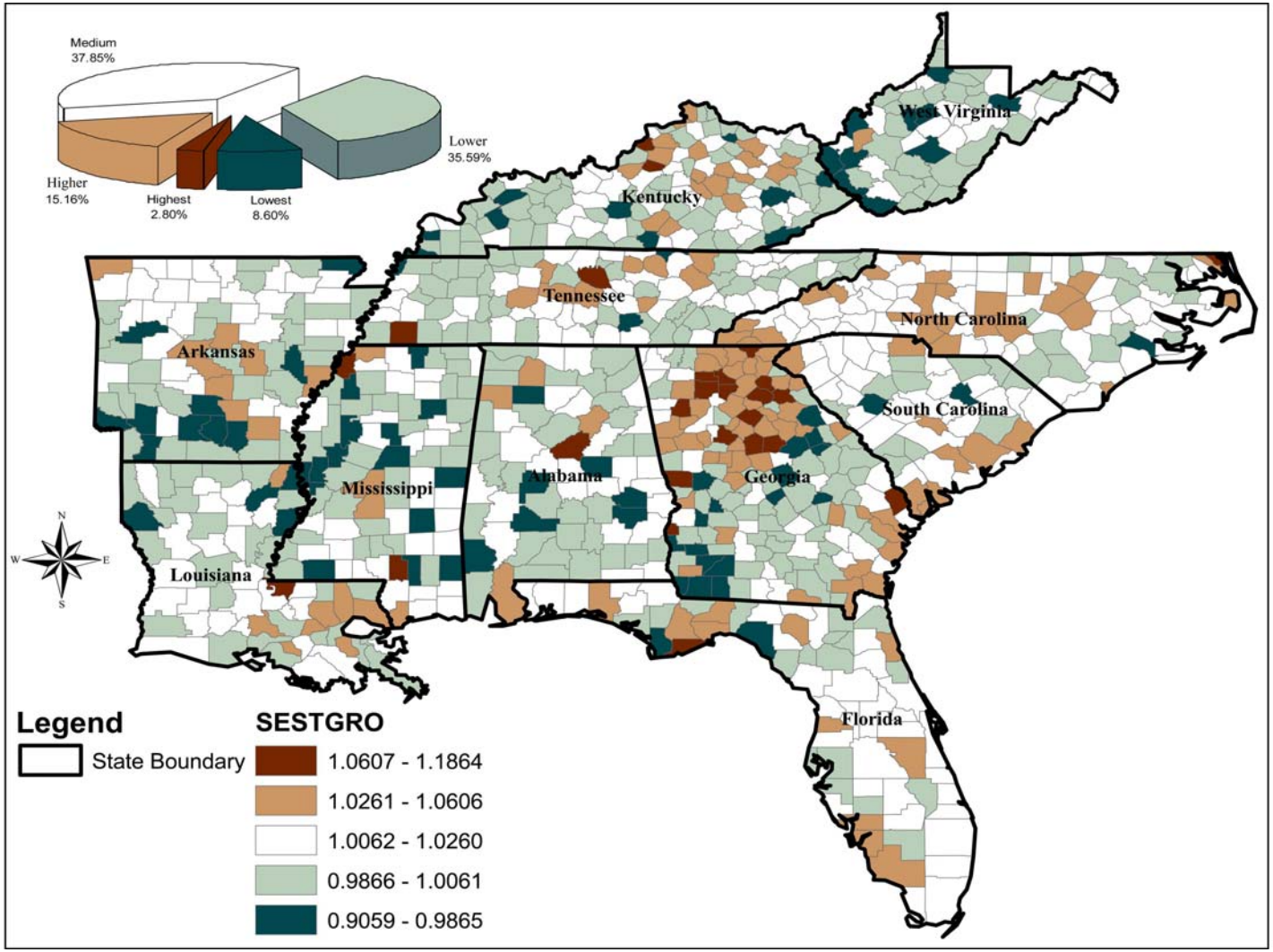


Figure 4.16 The Average Annual Rate of Change in the Total Number of Small Sized Establishments for the Southeast Region, 1995 – 2000

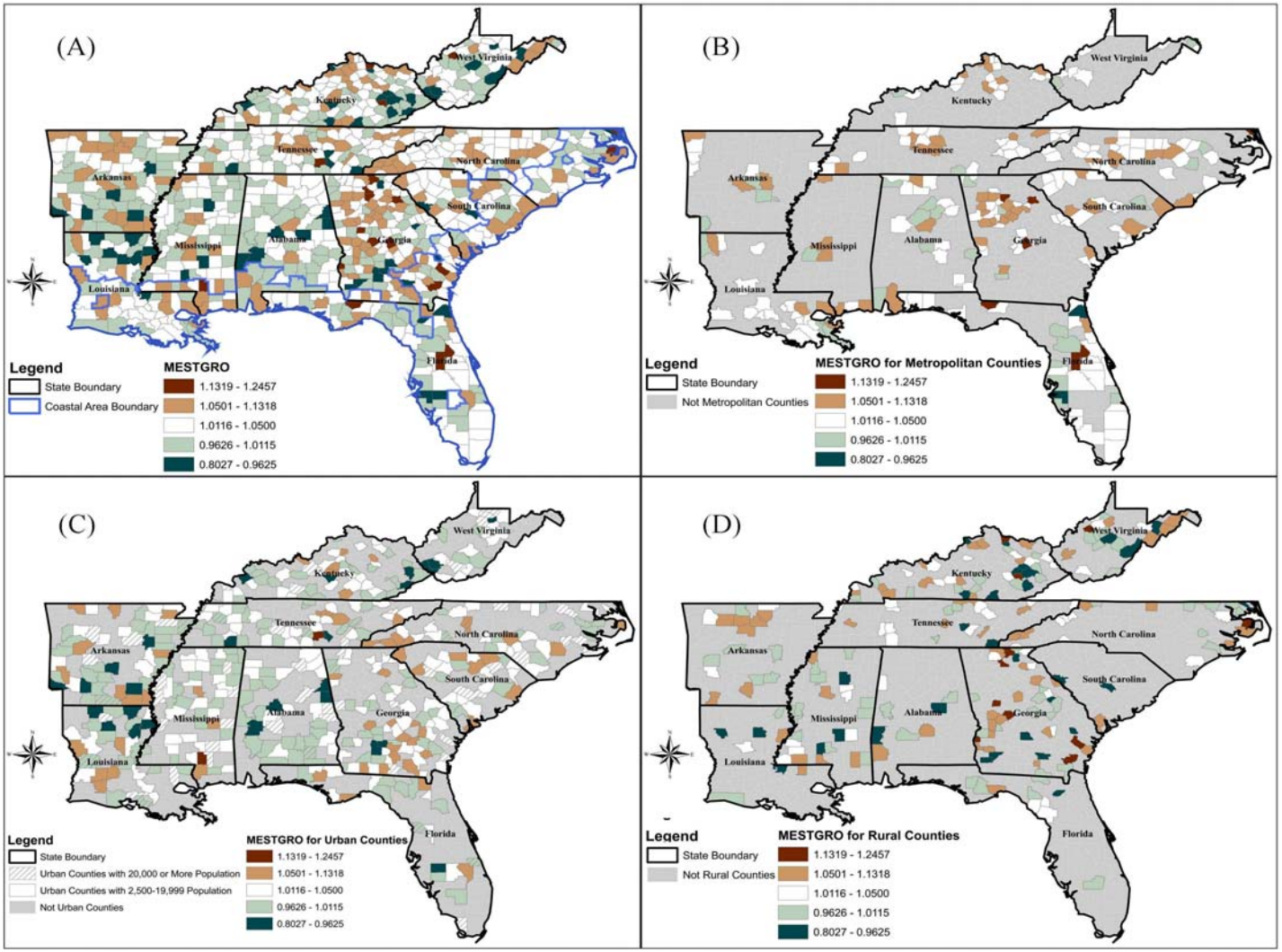


Figure 4.17 Coastal/Non-Coastal and Rural Urban Differences in the Average Annual Rate of Change in the Total Number of Small Sized Establishments for the Southeast, 1995 - 2000

During a period of 6 years from 1995 to 2000, Georgia (2.03% - *SESTGRO*) and North Carolina (1.77% - *SESTGRO*) have the highest average annual rate of change in the average of the total number of small sized establishments; these are the fastest growing small sized establishments states in the region. In contrast, West Virginia (-0.06% - *SESTGRO*) and Mississippi (0.41% - *SESTGRO*) have the lowest average annual rate of change in the average of the total number of small sized establishments; they are shown to be the slowest growing small sized establishments states in the region. On average, there are not many changes in the total number of small sized establishments from 1995 to 2000 in the following states: West Virginia (-0.06% - *SESTGRO*), Mississippi (0.41% - *SESTGRO*), Arkansas (0.45% - *SESTGRO*), Alabama (0.53% - *SESTGRO*), Kentucky (0.81% - *SESTGRO*), Louisiana (0.91% - *SESTGRO*), and Tennessee (0.96% - *SESTGRO*).

4.1.3.2 Total Number of Medium Sized Establishments

The average of the total number of medium sized establishments per county and its average annual rate of change from 1995 to 2000 are reported in Table 4.8. Figure 4.18 illustrates the average annual rate of change in the total number of medium sized establishments from 1995 to 2000 (*MESTGRO*) at the county level. From Table 4.8, the southeast region average for the total number of medium establishments per county increases by 13.4% (from 164 to 186) from 1995 to 2000. The *MESTGRO* per county for the Southeast region is 1.0250, which means that on average, the total number of medium sized establishments increases by 2.05% annually from 1995 to 2000. The range of *MESTGRO* is 0.80.27 (-19.73%) to 1.1257 (12.57%).

Table 4.8 The Average of the Total Number of Medium Sized Establishments per County and Its Average Annual Rate of Change, 1995 – 2000

RUC/Coastal /States	No. of Counties	Average of the Total Number of Medium Sized Establishments						*MESTGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	164	168	174	178	181	186	1.0250
Metro	250	476	488	506	517	529	542	1.0381
Urban 4 & 5	62	177	181	188	193	196	202	1.0231
Urban 6 & 7	397	49	50	52	52	53	54	1.0176
Rural	221	14	14	14	15	15	15	1.0239
Coastal	206	289	296	304	310	315	323	1.0296
Non-Coastal	724	129	132	137	140	143	147	1.0237
Alabama	67	162	166	172	174	177	177	1.0088
Arkansas	75	82	84	85	88	89	92	1.0203
Florida	67	574	582	593	603	611	625	1.0159
Georgia	159	132	135	140	144	147	153	1.0378
Kentucky	120	84	84	87	89	91	94	1.0236
Louisiana	64	179	183	188	195	194	197	1.0156
Mississippi	82	71	73	76	78	79	82	1.0220
N. Carolina	100	205	212	223	229	237	245	1.0342
S. Carolina	46	204	212	226	231	238	248	1.0326
Tennessee	95	159	162	168	172	175	180	1.0264
W. Virginia	55	74	75	80	80	80	82	1.0181

From Figure 4.18, from a total of 930 counties in the Southeast, 21.18% are in the high *MESTGRO* counties (2.04% - highest *MESTGRO* and 19.14% - higher *MESTGRO*), 44.95% fit in the medium *MESTGRO* counties, and 33.88% belong to the low *MESTGRO* counties (27.42% - lower *MESTGRO*, 6.45% - lowest *MESTGRO*).

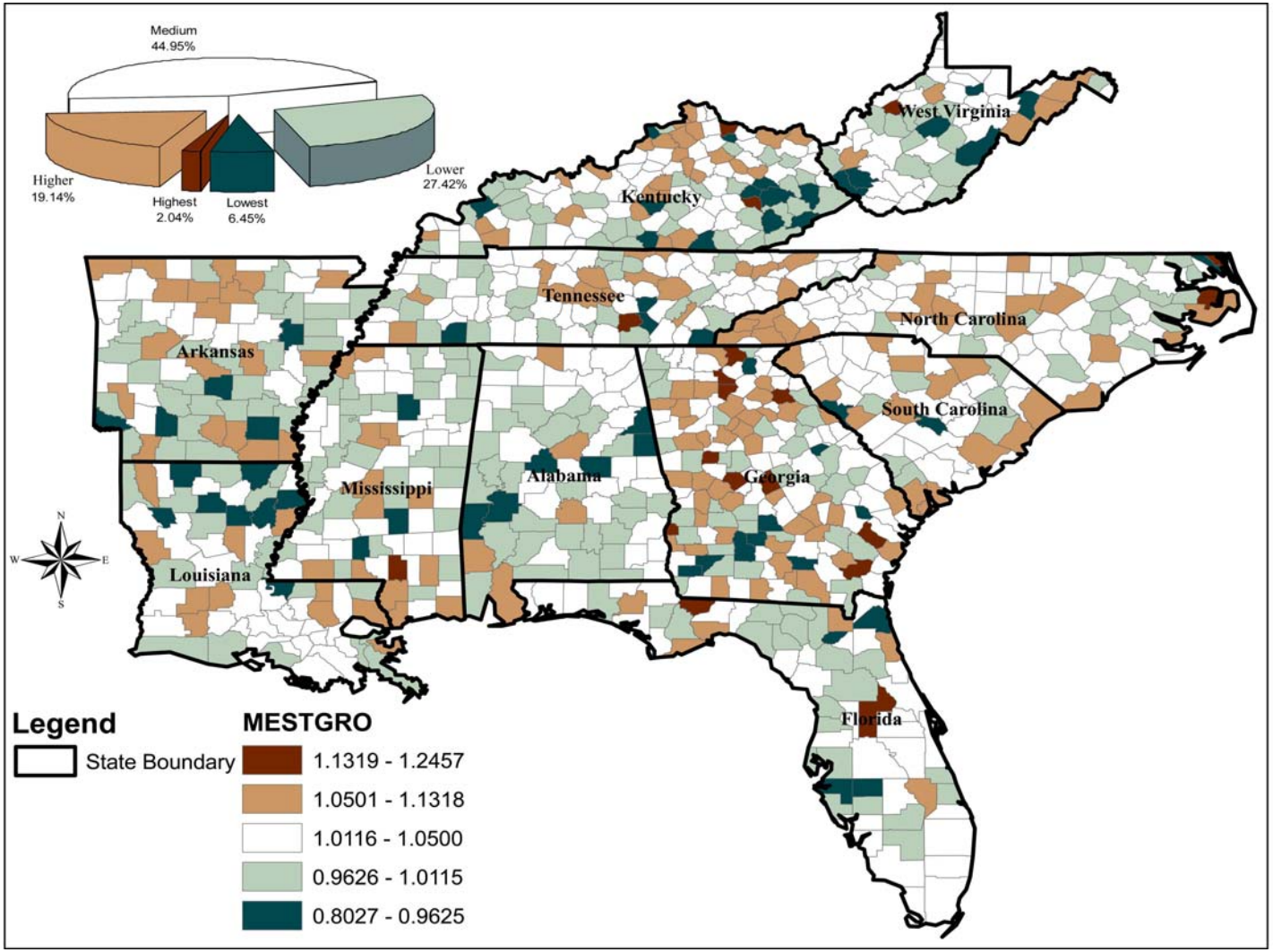


Figure 4.18 The Average Annual Rate of Change in Total Number of Medium Sized Establishments for the Southeast Region, 1995 – 2000

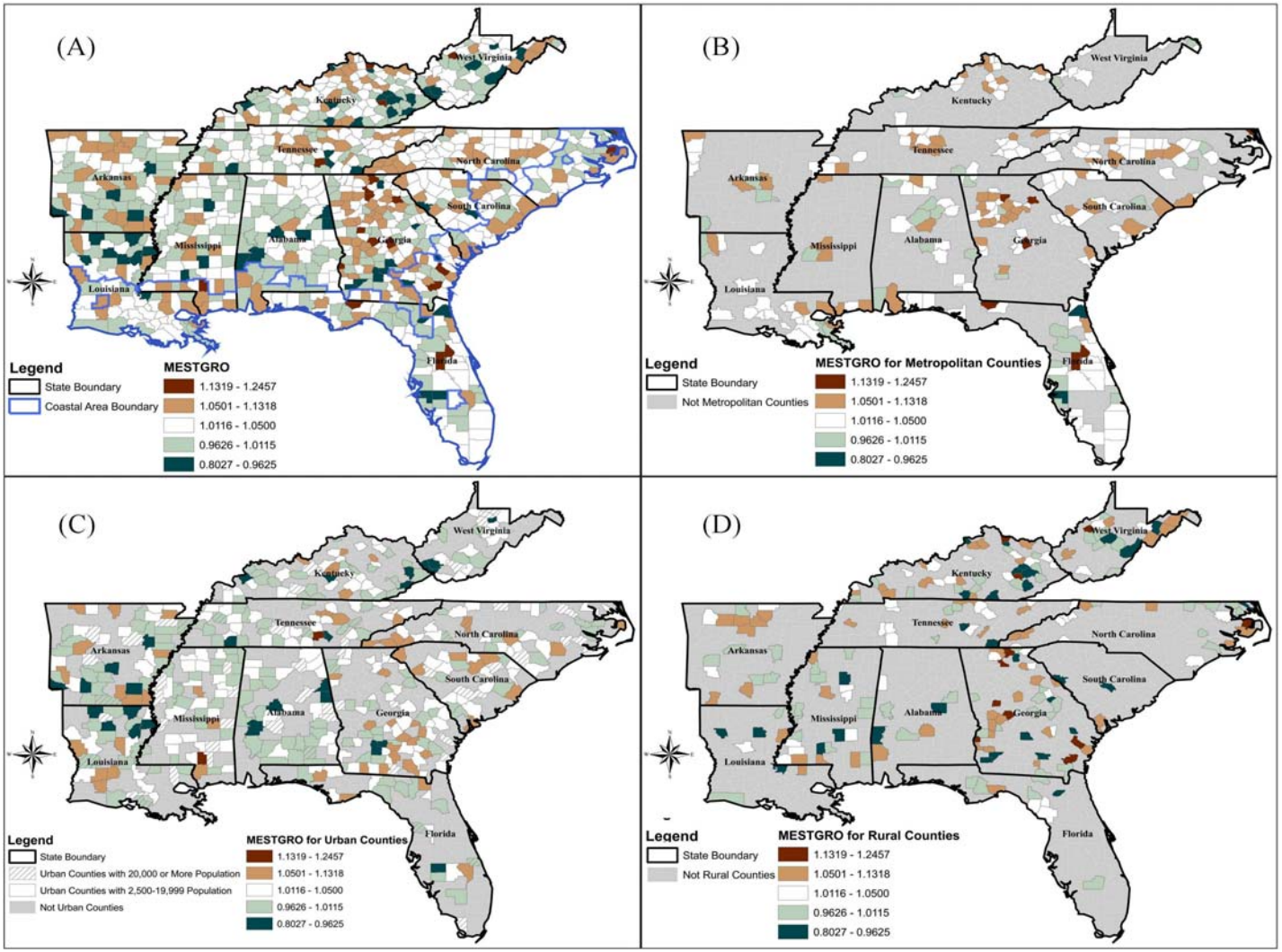


Figure 4.19 Coastal/Non-Coastal and Rural/Urban Differences in the Average Annual Rate of Change in the Total Number of Medium Sized Establishments for the Southeast, 1995 - 2000

From 1995 to 2000, the fastest growing areas for the medium sized establishments are the counties in metropolitan areas (3.81% average annual rate of change in the average of the total number of medium sized establishments (*MESTGRO*)) followed by rural counties (2.39% - *MESTGRO*).

Again, from 1995 to 2000, Georgia (3.78% - *MESTGRO*) and North Carolina (3.42% - *MESTGRO*) have the highest average annual rate of change in the average of the total number of medium sized establishments; their medium sized establishments are the fastest growing in the region. Alabama (0.88% - *MESTGRO*) and Louisiana (1.56% - *MESTGRO*) have the lowest average annual rate of change in the average of the total number of medium sized establishments; their medium sized establishments are the slowest growing in the region. The medium sized establishments are growing faster than the small sized establishments in all metro, urban, and rural counties. In South Carolina, West Virginia, Mississippi, and Georgia, the medium sized industries are growing much faster than the small sized industries. In Florida, Alabama, and Louisiana, the growth rate for the small sized establishments is almost same as the growth rate for the medium sized establishments.

4.1.3.3 Total Number of Large Sized Establishments

The average of the total number of large sized establishments per county and its average annual rate of change from 1995 to 2000 are reported in Table 4.9. Figure 4.20 illustrates the average annual rate of change in the total number of large sized establishments from 1995 to 2000 (*LESTGRO*) at the county level.

Table 4.9 The Average of the Total Number of Large Sized Establishments per County and Its Average Annual Rate of Change, 1995 -2000

RUC/Coastal /States	No. of Counties	Average of the Total Number of Large Sized Establishments						*LESTGRO*
		1995	1996	1997	1998	1999	2000	
Southeast	930	35	36	37	39	40	41	1.0098
Metro	250	100	105	108	112	116	119	1.0323
Urban 4 & 5	62	38	39	39	40	41	42	1.0184
Urban 6 & 7	397	12	12	12	12	12	12	1.0027
Rural	221	3	3	3	3	3	3	0.9946
Coastal	206	57	59	62	64	65	67	1.0082
Non-Coastal	724	29	30	31	31	32	33	1.0102
Alabama	67	36	37	36	37	38	38	0.9952
Arkansas	75	18	18	18	19	19	20	1.0163
Florida	67	115	120	127	132	136	140	1.0144
Georgia	159	29	31	32	32	35	36	1.0179
Kentucky	120	18	18	19	20	20	21	1.0280
Louisiana	64	34	35	35	36	36	36	0.9904
Mississippi	82	17	17	17	17	17	17	0.9993
N. Carolina	100	48	48	50	51	52	53	1.0033
S. Carolina	46	45	47	47	51	52	53	1.0250
Tennessee	95	36	37	39	40	41	42	0.9918
W. Virginia	55	14	14	13	14	14	14	1.0180

From Table 4.9, the southeast region average for the total number of large sized establishments per county increases by 17.4% (from 35 to 41) from 1995 to 2000. The average annual rate of change in the total number of large sized establishments per county for the southeast region is 1.0098, which means that, on average, the total number of medium sized establishments increases by 0.98% annually from 1995 to 2000. The range of *LESTGRO* is 0.6667 (-33.3%) to 1.3408 (34.08%).

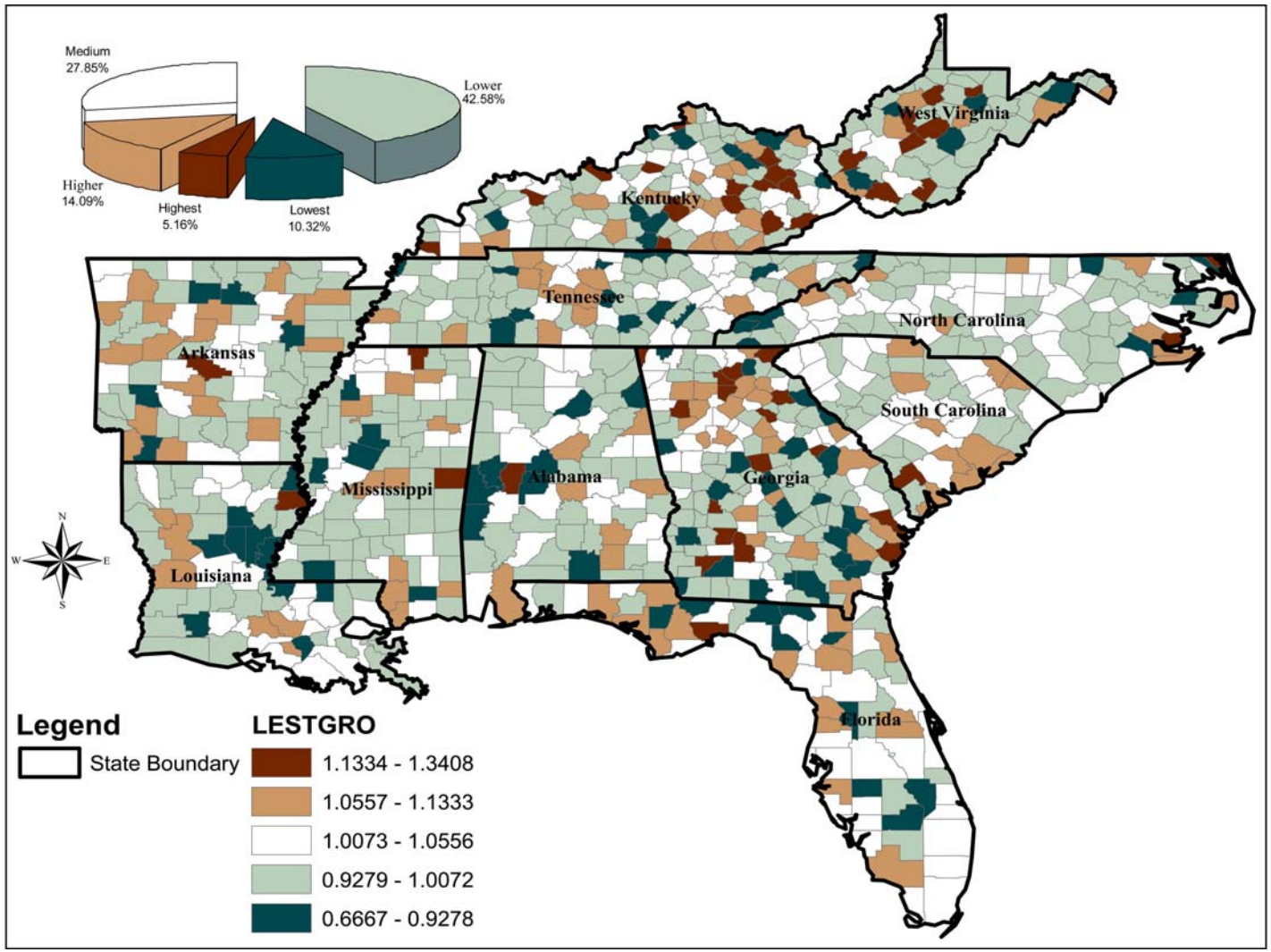


Figure 4.20 The Average Annual Rate of Change in the Total Number of Large Sized Establishments for the Southeast Region, 1995 – 2000

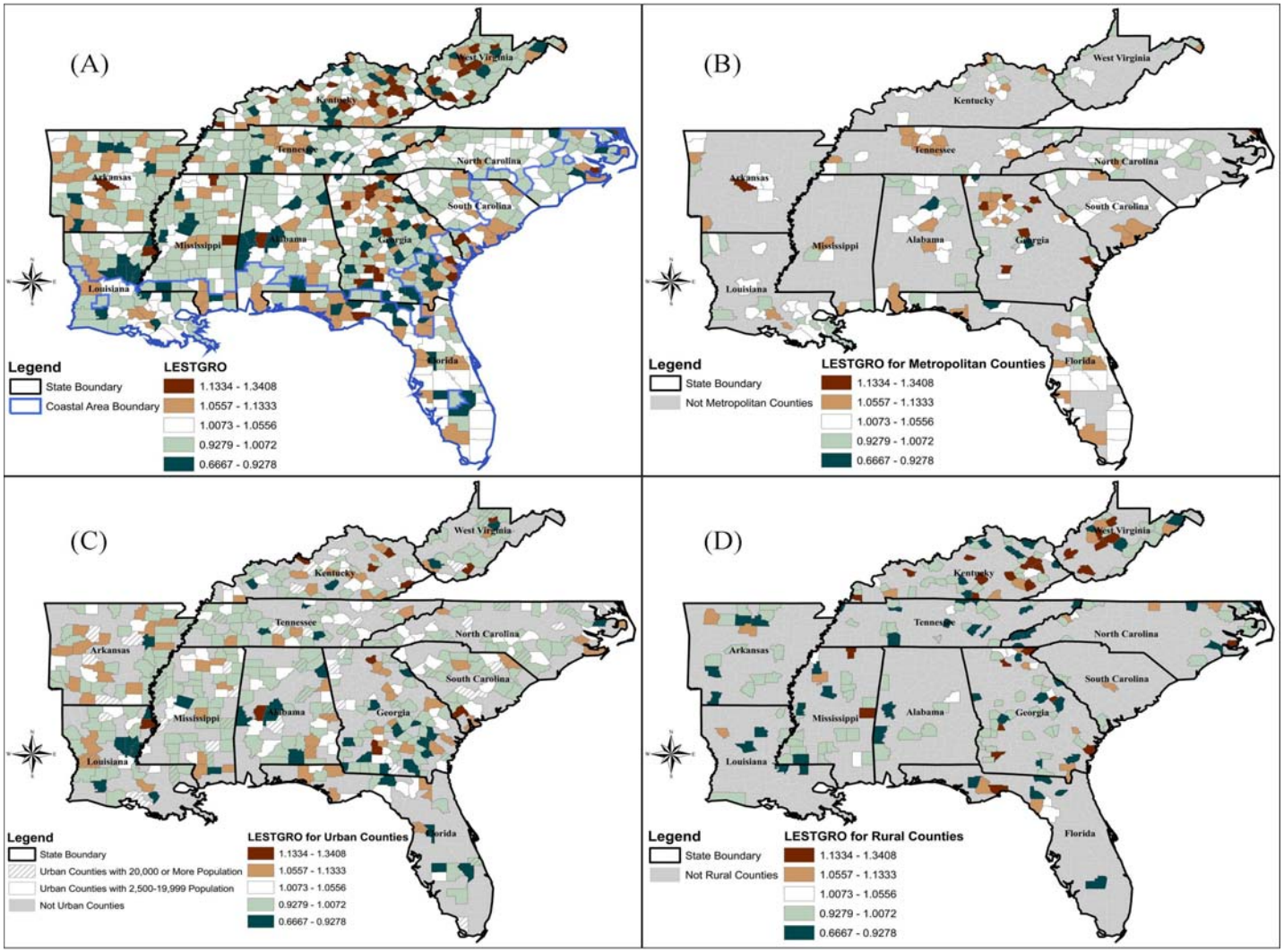


Figure 4.21 Coastal/Non-Coastal and Rural/Urban Differences in the Average Annual Rate of Change in the Total Number of Large Sized Establishments for the Southeast, 1995 - 2000

Illustrated in Figure 4.20, from a total of 930 counties in the Southeast, 19.25% are in the high *LESTGRO* counties (5.16% - highest *LESTGRO* and 14.09% - higher *LESTGRO*), 42.58% fit in the medium *LESTGRO* counties, and 52.90% belong to the low *LESTGRO* counties (42.58% - lower *LESTGRO*, 10.32% - lowest *LESTGRO*). For the previous areas covered in this chapter, growth in the large sized establishments is the most vital element for economic growth. Changes in the large sized establishments produce impacts that are very responsive to the local economy's outcome performances, such as growth in both employment and per capita income.

Counties in metropolitan areas and urban counties with a population of 20,000 or more have the fastest growth in the large sized establishments. The annual rate of change in the total number of large sized establishments is 3.23% and 1.84% respectively. There is little change in the large sized establishment's growth rate for the urban counties with a population between 2,500 and 19,999. For the rural counties, the growth rate declines slightly.

There are positive large establishment growth rates for Kentucky (2.80%), South Carolina (2.50%), West Virginia (1.80%), Georgia (1.79%), Arkansas (1.63%), and Florida (1.63%). However, there is little change in the growth of large sized establishments for North Carolina (0.33%), Mississippi (-0.07%), Alabama (-0.48%), Tennessee (-0.82%), and Louisiana (-0.96%). The reason for high *LESTGRO* in Kentucky and South Carolina is due to (in according to the "Selectory Business Database"[1] U.S. companies' database, in Kentucky and in South Carolina) the fact that

[1] Selectory Business Database features 23 million company records including in U.S. and Canada businesses, and 8 million international companies. Company profiles contain over 30 fields of information including contact details, 8 digit SIC codes, D-U-N-S numbers, web addresses, number of employees, etc.

25 and 26 large establishments (500 or more employees) were built from 1995 and 2000 respectively. This high growth in *LESTGRO* helped increase per capita personal income growth and the number of employment growth**.**

4.2 Analysis for Population Growth Variables

4.2.1 Population Density Growth

According to the U.S. Bureau of Census, the United States population density per square mile was 79.1 in 2000. On average, the southeast region's population density per square mile increased by 5.98% (from 117 people per square mile to 124 people per square mile) from 1995 to 2000. The average annual rate of change in population growth per square mile (*DENGRO*) for the southeast region was 1.0099. The range of *DENGRO* is from 0.9777 (-2.23%) to 1.1067 (10.67%). The average annual population density and its average annual rate of change from 1995 to 2000 were reported in Table 4.10. Figure 4.22 illustrates the average annual rate of change in population density from 1995 to 2000 at the county level. Figure 4.23 demonstrates the geographic distribution of the average annual rate of change in population density from 1995 to 2000.

The most densely populated states in the Southeast are Florida (the largest density), North Carolina, Georgia, Tennessee, South Carolina, and Kentucky. The sparsely populated states in the Southeast were Arkansas (the smallest density), Mississippi, Alabama, and West Virginia.

Table 4.10 The Average Population Density per Square Mile for a County and Its Average Annual Rate of Change, 1995 - 2000

RUC/Coastal /States	No. of Counties	Average Population Density per Square Mile						
		1995	1996	1997	1998	1999	2000	*DENGRO*
Southeast	930	117	118	119	121	122	124	1.0099
Metro	250	284	288	292	296	299	303	1.0161
Urban 4 & 5	62	128	129	130	131	132	132	1.0053
Urban 6 & 7	397	56	56	57	57	58	58	1.0072
Rural	221	33	34	34	34	35	35	1.0092
Coastal	206	161	162	164	166	167	169	1.0112
Non-Coastal	724	104	105	107	108	109	111	1.0096
Alabama	67	78	78	79	80	80	80	1.0054
Arkansas	75	45	46	46	47	47	47	1.0049
Florida	67	245	249	253	256	260	263	1.0165
Georgia	159	139	142	145	148	151	154	1.0170
Kentucky	120	100	101	102	103	103	104	1.0087
Louisiana	64	142	143	143	143	143	143	1.0032
Mississippi	82	55	55	56	56	57	57	1.0058
North Carolina	100	147	149	152	154	156	158	1.0131
South Carolina	46	110	111	113	114	115	117	1.0085
Tennessee	95	111	113	114	116	117	118	1.0136
West Virginia	55	95	95	95	95	95	94	0.9996

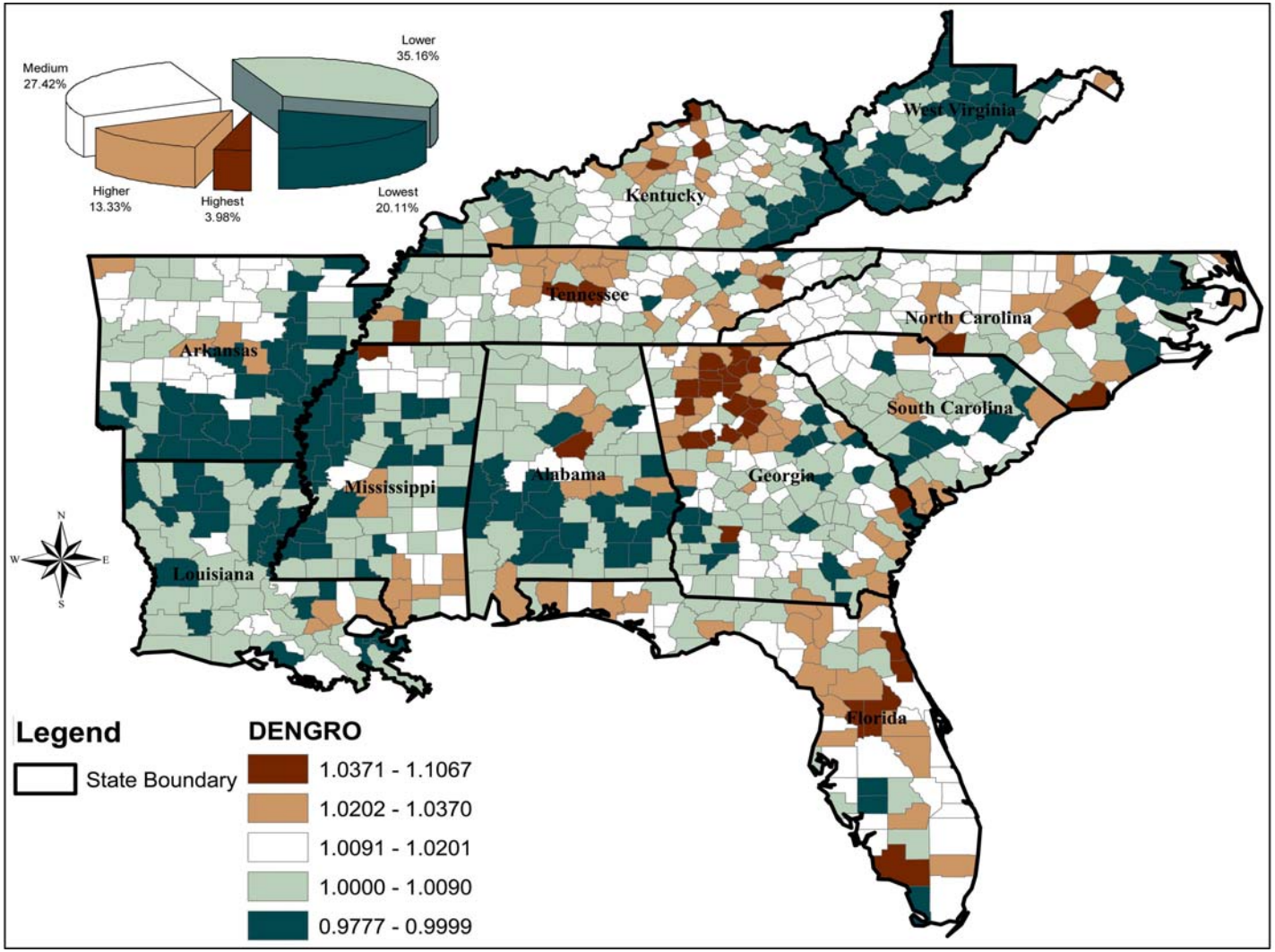


Figure 4.22 The Average Annual Rate of Change in the Population Density per Square Miles for the Southeast Region, 1995 – 2000

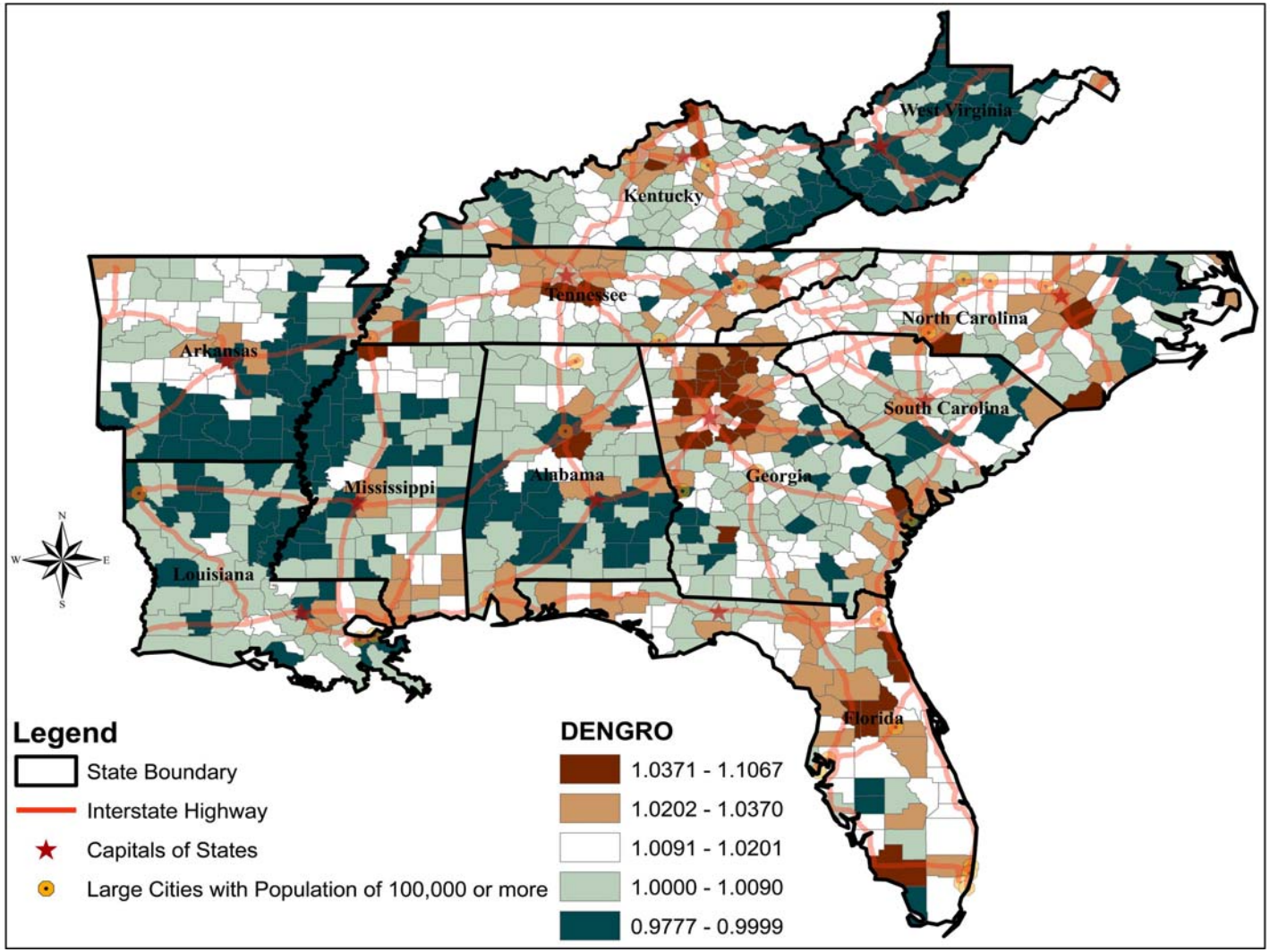


Figure 4.23 Spatial Distribution of the Average Annual Rate of Change in the Population Density for the Southeast Region, 1995 – 2000

In Figure 4.22 and Figure 4.23, *DENGRO* data is visualized into the 5 natural break classes. From a total of 930 counties in the Southeast, 17.31% of the counties are in the high *DENGRO* counties (3.98% - highest *DENGRO* and 13.33% - higher *DENGRO*), 27.42% of the counties fit in the medium *DENGRO* counties, and 55.27% of the counties belong to the low *DENGRO* counties (35.16%-lower *DENGRO*, 20.11% - lowest *DENGRO*).

Although the Southeast population increases from 1995 to 2000, the geographic pattern of the population growth, especially density growth, has a geographic distribution similar to the characteristics of *PINCGRO* and *EMPGRO*. The spatial trends of *DENGRO* follow the interstate highways. Counties that are closer to the interstate highways have a higher *DENGRO* than other counties. However, *DENGRO* is not high in metropolitan counties with large cities but is high in counties in metropolitan areas and surrounding of the large cities. This suggests that the population growth has not occurred in central big cities, but rather in the extended city areas (the built-up area of central place or continuous built-up areas). Rural counties neighboring with metropolitan counties have high *DENGRO*. This phenomenon supports theories stressing agglomeration. These characteristics emphasize the differences in urban and rural, which illustrate their important role in the *DENGRO* pattern. In addition, coastal and non-coastal differences are essential to *DENGRO* geographical patterns. Descriptive statistics for urban and rural differences and coastal and non-coastal differences in *DENGRO* for the 5 natural break classification schemes are reported in Table 4.11 and visualized in Figure 4.24. Illustrated in Table 4.10, population density of counties in metropolitan areas is 8.6 times greater than rural counties. Counties in metropolitan areas are the largest share of the

highest *DENGRO* and the higher *DENGRO* counties. In the low *DENGRO* counties class, 37.60% of metropolitan counties, 66.13% of urban 4 &5 counties, 62.97% of urban 6 & 7 counties, and 58.37% of rural counties are included.

Coastal counties generally have higher population densities than non-coastal areas. From 1995 to 2000, on average, the population density is higher than the average population density for the Southeast and the non-coastal counties. In 2000, 241.3 million people (about 40% of the total Southeast population) resided along the narrow coastal fringes. The average annual rate of change in population density per square mile (*DENGRO*) for coastal counties is faster than *DENGRO* for the region and for the non-coastal counties.

The population growth (economic growth) factor depends not only on economic growth (population) but also on demographic characteristics (such as natural increase, median age, race, and gender), socioeconomic level of 1990 (such as housing dimension, education dimension, and economic opportunities), and gravity toward the cities. Due to economic landscape agglomeration, population growth is also different in urban/rural areas, as well as coastal/non-coastal areas.

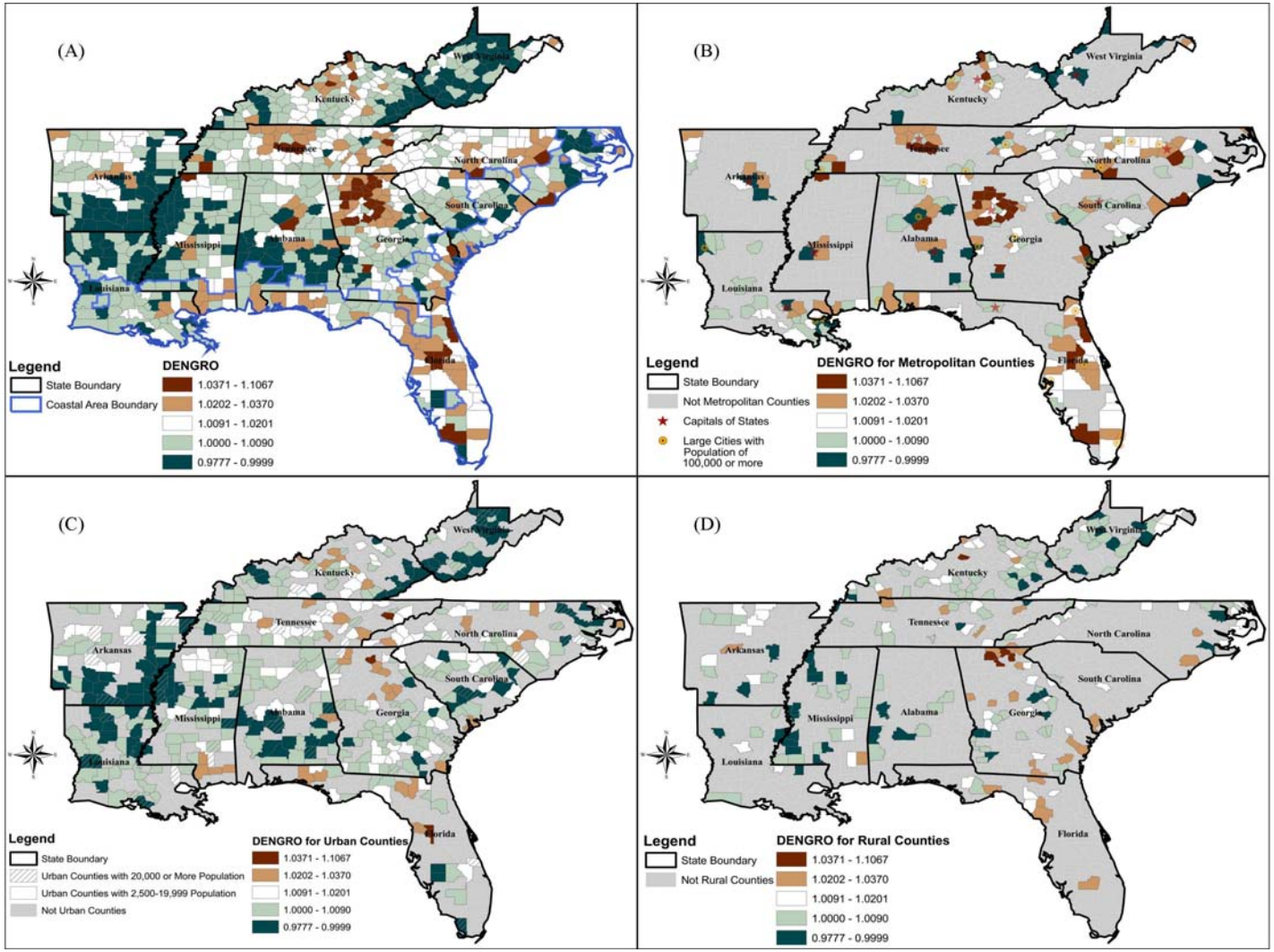


Figure 4.24 Coastal/Non-Coastal and Rural/Urban Differences in Average Annual Rate of Change in the Population Density for the Southeast, 1995 - 2000

Table 4.11 Descriptive Statistics for *DENGRO*, by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*DENGRO* Mean	*DENGRO* Std. Dev.
Southeast	Total	930	1.0099	0.0131
[0.9777-1.1067]	Metropolitan	250	1.0162	0.0166
	Urban 4 & 5	62	1.0054	0.0090
	Urban 6 & 7	397	1.0070	0.0100
	Rural 8 & 9	221	1.0094	0.0123
	Coastal	206	1.0112	0.0120
	Non-Coastal	724	1.0096	0.0134
Highest *DENGRO*	Total	37	1.0488	0.0142
[1.0371 - 1.1067]	Metropolitan	29	1.0483	0.0149
	Urban 4 & 5	0	-	-
	Urban 6 & 7	3	1.0434	0.0075
	Rural 8 & 9	5	1.0555	0.0123
	Coastal	7	1.0439	0.0055
	Non-Coastal	30	1.0500	0.0154
Higher *DENGRO*	Total	124	1.0266	0.0046
[1.0202 - 1.0370]	Metropolitan	56	1.0273	0.0046
	Urban 4 & 5	4	1.0243	0.0051
	Urban 6 & 7	34	1.0263	0.0042
	Rural 8 & 9	30	1.0261	0.0049
	Coastal	36	1.0273	0.0049
	Non-Coastal	88	1.0264	0.0045
Medium *DENGRO*	Total	255	1.0137	0.0031
[1.0091 - 1.0201]	Metropolitan	71	1.0142	0.0031
	Urban 4 & 5	17	1.0131	0.0030
	Urban 6 & 7	110	1.0134	0.0032
	Rural 8 & 9	57	1.0138	0.0032
	Coastal	57	1.0137	0.0029
	Non-Coastal	198	1.0137	0.0032
Lower *DENGRO*	Total	327	1.0046	0.0025
[1.0000 - 1.0090]	Metropolitan	62	1.0044	0.0025
	Urban 4 & 5	21	1.0048	0.0023
	Urban 6 & 7	158	1.0045	0.0025
	Rural 8 & 9	86	1.0050	0.0025
	Coastal	77	1.0049	0.0024
	Non-Coastal	250	1.0045	0.0025
Lowest *DENGRO*	Total	187	0.9953	0.0039
[0.9777-0.9999]	Metropolitan	32	0.9954	0.0029
	Urban 4 & 5	20	0.9957	0.0039
	Urban 6 & 7	92	0.9952	0.0044
	Rural 8 & 9	43	0.9954	0.0033
	Coastal	29	0.9956	0.0035
	Non-Coastal	158	0.9953	0.0039

Most of the areas of Arkansas, Alabama, Louisiana, Mississippi (including the Delta region along the Mississippi River), West Virginia, southern Georgia, western and southern Tennessee, and the Piedmont region contain cold spots for *DENGRO.* Many of the hot spots for *DENGRO* follow interstate highways and the coastal counties of the Southeast. There is a positive correlation between *DENGRO*, *PINCGRO*, and *EMPGRO*. Detailed analysis towards the correlation is provided at the end of Chapter IV. The rapid population growth of coastal areas and the related development and economic growth have both positive and negative connotations. Although growth brings about jobs, creates economic prosperity, adds new industries, and pulls people to the area, it also creates a burden on the local environment and increases demands for infrastructure.

Illustrated in Table 4.1, on average, the population density for Florida, Georgia, North Carolina, South Carolina, Tennessee, and the southeast region has increased slightly from year to year; in other words, the population density trend is positive with respect to time. However, the population density for Alabama, Arkansas, Kentucky, Louisiana, Mississippi, and West Virginia is fairly constant from year to year. The highest population density states during the study period are Florida (2.1 times above the Southeast average and approximately 25.4% of the Southeast population), North Carolina (1.3 times above the Southeast average and about 12.8% of the Southeast population), and Georgia (1.2 times above the Southeast average and approximately 13.2% of the Southeast population). The lowest population density states are Arkansas (2.6 times below the Southeast average and 4.3% of the Southeast population), Mississippi (2.1 times below the Southeast average and approximately 4.6% of the Southeast population), Alabama (1.5 times below the Southeast average and about 7.3% of the Southeast

population), and West Virginia (1.3 times below the Southeast average and about 3.0% of the Southeast population). Florida's rapid growth has occurred in part due to general tourism and retirement communities, especially along its western coast (Stallmann, Judith and Maria Cristina Espinoza, 1996). Dare (North Carolina), Dorchester (South Carolina), and Berkeley (South Carolina) are counties characterized by economic growth and the relocating of retirees that have fueled the rapid population growth (Stallmann, Judith and Maria Cristina Espinoza, 1996). Again, agglomeration and built–up extended cities in metropolitan areas have played the main role for a faster *DENGRO*. The majority of Arkansas, Mississippi, Alabama, and West Virginia areas are small urban counties (with an urban population between 2,500 and 19,999), and/or completely rural counties or urban counties with an urban population of less than 2,500. The coastal counties of Mississippi and Alabama have a faster *DENGRO* and faster economic growth factor.

Population growth can arise from increased births, decreased deaths, or increased net in-migration; migration plays an essential role in the United States population growth. There are many complex and in-depth empirical forms of evidence that advocate that economic benefits to agglomeration exist and have quantitatively significant effects on the migration of labor and the location of industry. (Hanson, Gordon H., 2000)

In-migration and out-migration are discussed in the following section. Natural increase is discussed in the exogenous variable description analysis part of Chapter IV. Demographic characteristics (which influence population growth, economic growth, and social development), as well as age selectivity, racial characteristics, human capital spillover factors are discussed in the exogenous variable description analysis section of Chapter IV.

4.2.2 Migration

In-migration and out-migration levels and rates per 1000 population for the Southeast during the study period are shown in Table 4.12. On average, the Southeast has positive net-migration (in-migration minus out-migration) between 1995 and 2000 within the southeast region. On average, in each year, the Southeast has 38 in-migrants per 1000 people and 32 out-migrants per 1000 people between 1995 and 2000. The range of in-migration rates (*IMMR*) for the Southeast from 1995 to 2000 is from 10 in-migrants per 1000 people (Harlan County, KY) to 119 in-migrants per 1000 people (Chattahoochee County, GA). The range for out-migration rates (*OMMR*) for the Southeast from 1995 to 2000 is from 18 out-migrants per 1000 people (Lincoln County, West Virginia) to 188 out-migrants per 1000 people (Chattahoochee County, GA,).

Table 4.12 The Average of the Number of People Who In- and Out-Migrated from 1995 to 2000 and Their Migration Rates, by RUC

RUC/Coastal /States	No of Counties	Average Inflow		Average Outflow	
		Number	In-Migration Rate per 1000 People	Number	Out-Migration Rate per 1000 People
Southeast	930	12790	38.0782	11063	32.2891
Metro	250	33284	45.4057	28718	35.9439
Urban 4 & 5	62	13223	37.3254	12285	35.8509
Urban 6 & 7	397	5289	33.7167	4547	30.4282
Rural	221	2962	37.8354	2453	30.4983
Coastal	206	22883	40.9794	19834	33.7038
Non-Coastal	724	9919	37.2528	8567	31.8866
Alabama	67	10329	31.1398	9944	30.3093
Arkansas	75	6839	38.3339	6278	37.1805
Florida	67	47354	52.1379	38294	36.4122
Georgia	159	12643	45.8833	10500	35.6065
Kentucky	120	5713	34.7456	5429	30.7976
Louisiana	64	10025	30.3977	11209	31.0558
Mississippi	82	5805	31.8303	5476	30.6565
North Carolina	100	16580	40.5691	13201	31.6393
South Carolina	46	16423	35.1521	13549	30.1334
Tennessee	95	10860	38.7524	9320	29.2158
West Virginia	55	4703	28.7682	4898	28.8337

4.2.2.1 In-migration

Illustrated in Table 4.12, Florida (highest – *OMMR* = 52.13), Georgia, North Carolina, Tennessee, and Arkansas have above the Southeast average in-migration rates (*IMMR)*; West Virginia (lowest – *IMMR* = 28.76), Louisiana, Alabama, Mississippi, Kentucky, and South Carolina had below the Southeast average *IMRR*. On average, Florida has the highest number of people employed, while West Virginia has the lowest

number of people employed from 1995 to 2000. On average, Florida has the highest real per capita personal income; Mississippi, followed by West Virginia has the lowest real per capita personal income from 1995 to 2000. On average, Florida has the highest number of establishments while West Virginia has the lowest number of establishments.

In terms of growth rates, the average annual rate of change in real per capita personal income, the number of people employed, and the number establishments are all highest for Florida and lowest for West Virginia. These interdependence relationships are also strongly connected with the interdependency between cities and metropolitan areas (or role of the cities) and agglomeration. This is illustrated by Florida being a metropolitan area with the highest number of large cities with a population greater than 100,000 people, while West Virginia has no large cities with a population greater than 100,000 and shows lower economic growth characteristics. Except for six counties, all counties of Florida are coastal counties. Figure 4.25 illustrates in-migration rate (*IMRR*) per 1000 people from 1995 to 2000 at the county level. The geographic distribution for the *IMRR* is demonstrated in Figure 4.26 and Figure 4.27. In Figure 4.25, *IMRR* data are visualized as the 5 natural break classes. From a total of 930 counties in the Southeast, 20.53% are in the high *IMRR* counties, 20.65% fit in the medium *IMRR* counties, and 58.82% belong to the low *IMRR* counties.

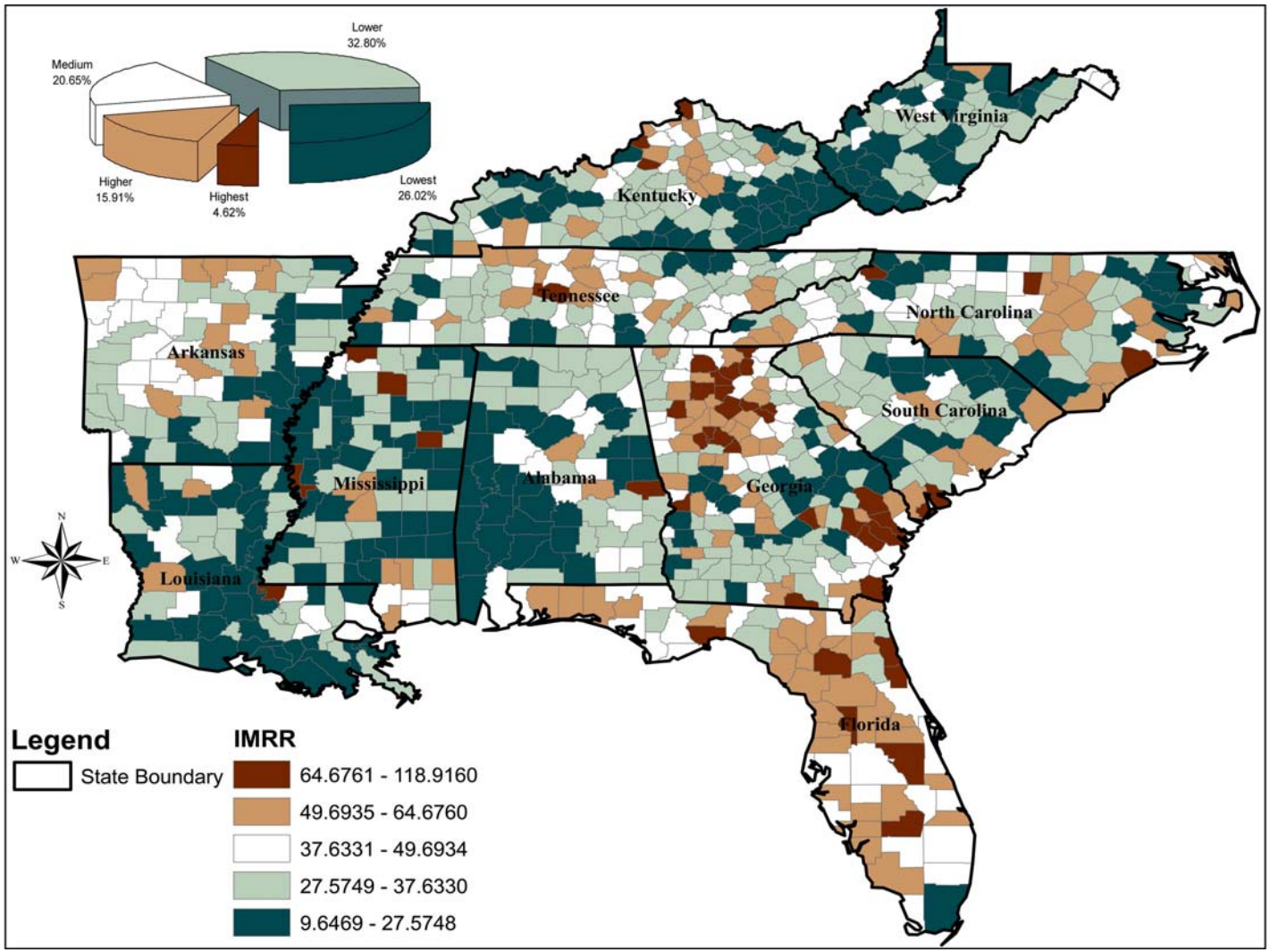


Figure 4.25 In-Migrants per 1000 People for the Southeast Region, 1995 – 2000

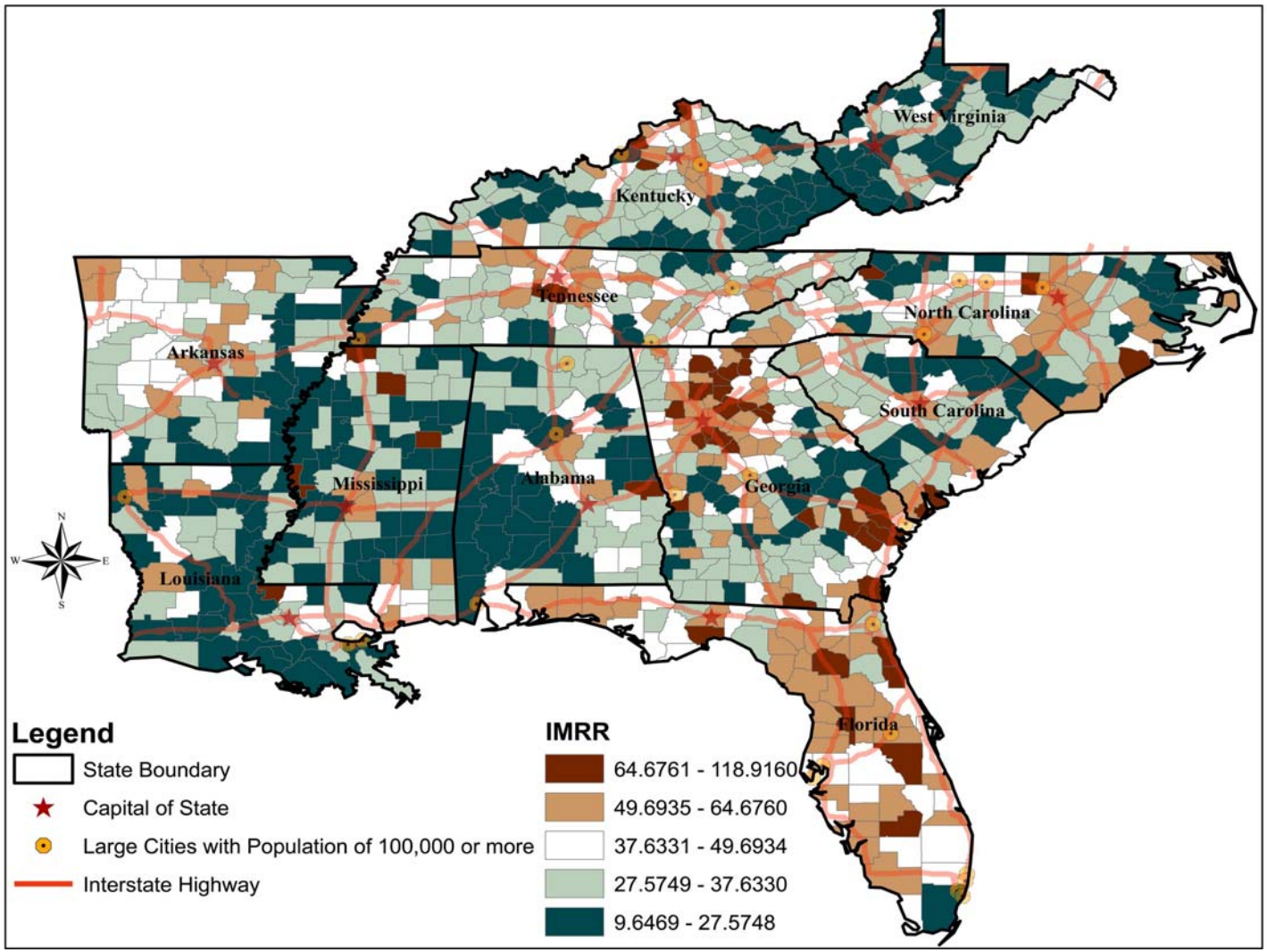


Figure 4.26 Spatial Distribution of the In-Migrants per 1000 People for the Southeast Region, Interstate, and Large Cities Influences, 1995 – 2000

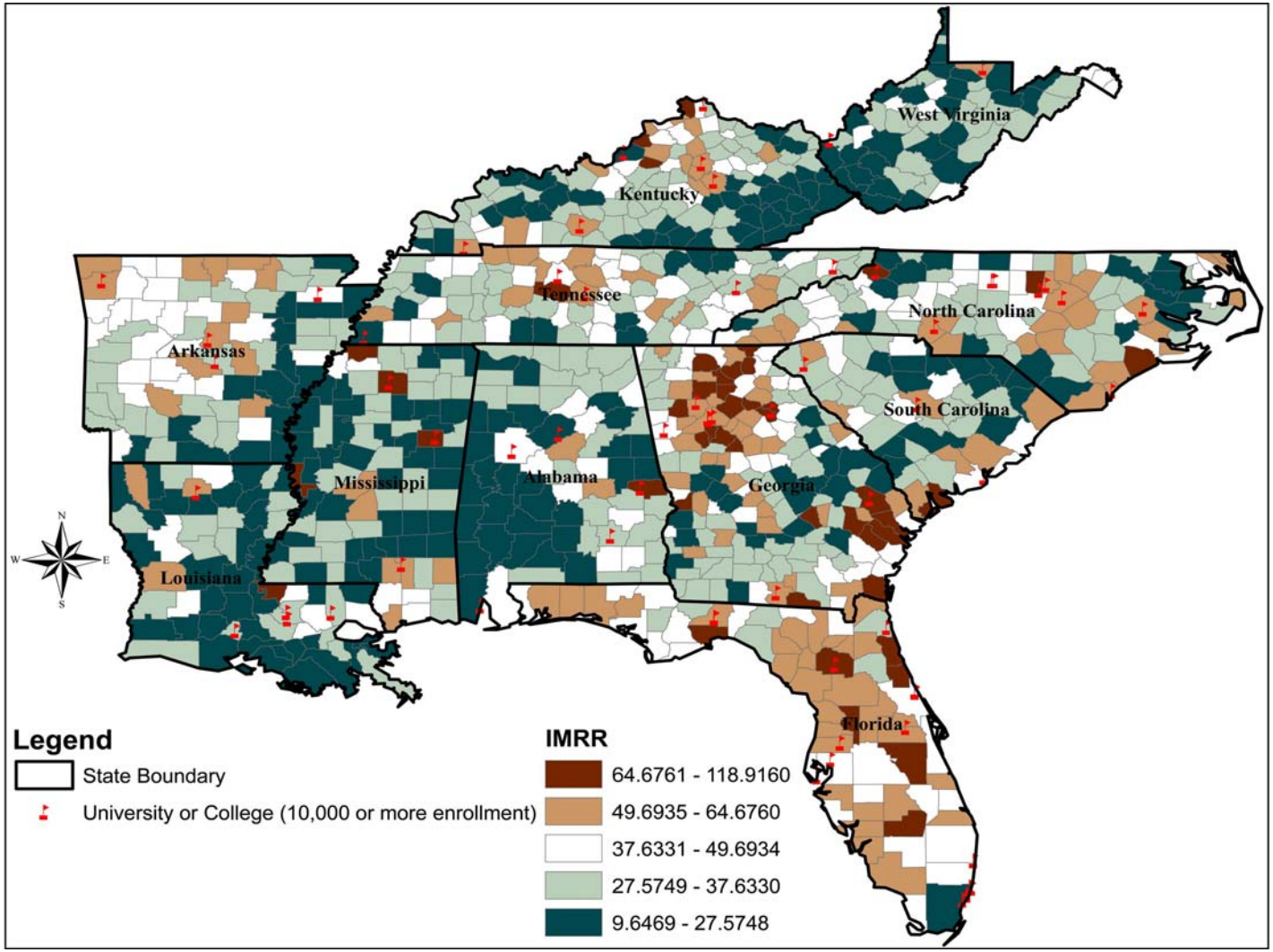


Figure 4.27 Spatial Distribution of In-Migrants per 1000 People for the Southeast Region and Big Universities Influence, 1995 – 2000

Figure 4.26 and Figure 4.27 illustrate that the characteristics of geographic distribution of *IMRR* are similar to the characteristics of *DENGRO*, *PINCGRO*, and *EMPGRO*. The spatial trends of *IMRR* follow the interstate highways and large universities with enrollment of students greater than 10,000. Counties that are closer to the interstate highways have a higher *IMRR,* while counties that are further from the interstate highways have a lower *IMRR*. *IMRR*s are not high in counties with large cities but are high in neighboring metropolitan counties with counties with large cities. Moreover, eastern rural counties (especially Georgia's rural counties) neighboring with metropolitan counties also have high *IMRRs*. Counties including a university with a significant enrollment of students also have high *IMRRs*, which confirms that one of the most essential pull characteristics of migration is human capital spillovers and technology. Coastal counties have high *IMRRs*. These characteristics emphasize the differences in urban/rural and coastal/non-coastal counties. Education plays a significant role in the pattern of *IMRR*.

Figure 4.28 illustrates *IMRR* by coastal and non-coastal counties, counties in metropolitan areas, urban counties, and rural counties. Table 4.13 provides rural and urban, as well as coastal and non-coastal differences in *IMRR* by the 5 natural break classes. Additional details are provided for *IMRR* and *OMRR* comparison in the following.

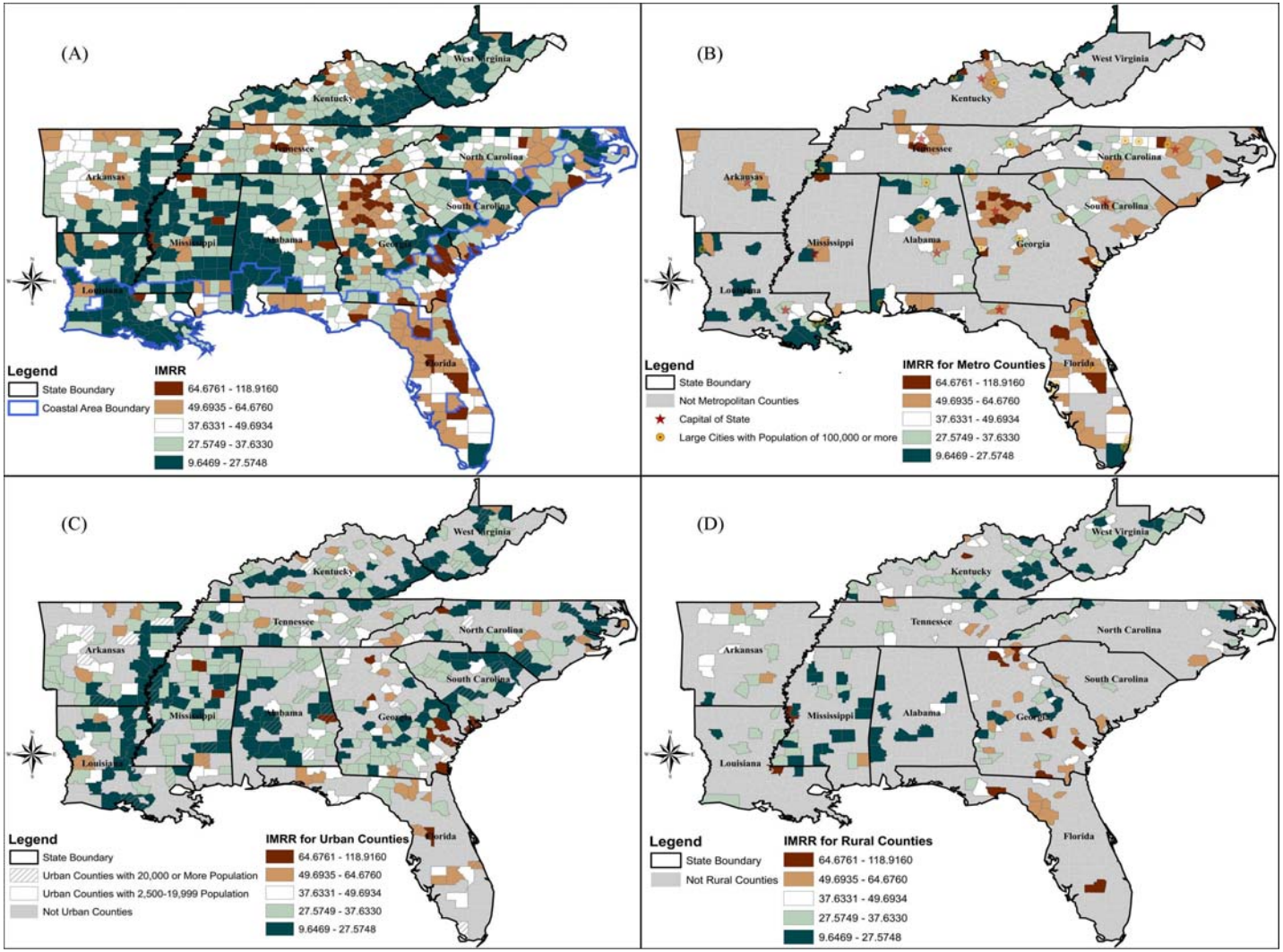


Figure 4.28 Coastal/Non-Coastal and Rural/Urban Differences in *IMRR* for the Southeast, 1995 -2000

Table 4.13 Descriptive Statistics for *IMRR*, by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*IMRR*	
			Mean	Std. Dev.
Southeast	Total	930	38.0782	14.7738
[9.6469 -118.9160]	Metropolitan	250	45.2340	16.0691
	Urban 4 & 5	62	37.5961	15.1972
	Urban 6 & 7	397	33.6266	11.8994
	Rural 8 & 9	221	38.1156	14.7138
	Coastal	206	40.9794	16.8355
	Non-Coastal	724	37.2528	14.0359
Highest *IMRR*	Total	43	77.4679	11.0122
[65.9294 - 118.9160]	Metropolitan	20	77.9695	12.8362
	Urban 4 & 5	3	77.2050	6.1274
	Urban 6 & 7	9	76.7636	13.2265
	Rural 8 & 9	11	77.2039	6.9111
	Coastal	15	77.9699	11.3792
	Non-Coastal	28	77.1990	11.0130
Higher *IMRR*	Total	148	56.4528	4.2672
[49.7826 - 65.9293]	Metropolitan	76	57.3826	4.2682
	Urban 4 & 5	10	55.1471	4.2196
	Urban 6 & 7	30	54.5547	3.8908
	Rural 8 & 9	32	56.4320	4.0971
	Coastal	45	57.0890	3.9899
	Non-Coastal	103	56.1748	4.3725
Medium *IMRR*	Total	192	43.3421	3.3584
[37.6331 - 49.7825]	Metropolitan	65	43.2065	3.5338
	Urban 4 & 5	12	44.8832	4.0520
	Urban 6 & 7	66	43.0653	3.0116
	Rural 8 & 9	49	43.5176	3.3810
	Coastal	45	43.5247	3.5414
	Non-Coastal	147	43.2862	3.3110
Lower *IMRR*	Total	305	32.2560	2.7555
[27.5749 - 37.6330]	Metropolitan	52	32.7501	2.7422
	Urban 4 & 5	18	32.5530	2.7879
	Urban 6 & 7	163	31.9692	2.7267
	Rural 8 & 9	72	32.4743	2.8010
	Coastal	50	32.0698	2.6297
	Non-Coastal	255	32.2925	2.7830
Lowest *IMRR*	Total	242	23.0035	3.6423
[9.6469- 27.5748]	Metropolitan	37	23.6922	3.4397
	Urban 4 & 5	19	22.2800	3.3427
	Urban 6 & 7	129	23.0151	3.6430
	Rural 8 & 9	57	22.7712	3.8748
	Coastal	51	22.3745	3.4162
	Non-Coastal	191	23.1714	3.6907

4.2.2.2 Out-migration

From Table 4.12, Arkansas (highest), Florida, and Georgia, have above the Southeast average *OMMR*; West Virginia (lowest), Tennessee, South Carolina, Mississippi, and others have below the Southeast average *OMRR*. Figure 4.29 illustrates out-migration rate (*OMRR*) per 1000 people from 1995 to 2000 at the county level, which is visualized as the 5 natural break classes. Southerners appear less likely to out-migrate. From a total of 930 counties in the Southeast, only 8.50% are in the high *OMRR* counties (1.51% - highest *OMRR*, 6.99% - higher *OMRR*), 22.8% fit in the medium *OMRR* counties, and 68.71% belong to the low *OMRR* counties (37.74% - lower *OMRR*, 30.97% - lowest *OMRR*). Figure 4.30 and 3.31 illustrate the characteristics of the geographic distribution of *OMRR*. It would appear that counties with large cites have a high out-migration rate since the county is highly densely populated. However, if a densely populated county or a county has higher in-migration rates than out-migration rates, this would mean a sign of economic growth and stimulation toward higher population growth.

The spatial trends of *OMRR* follow big universities, which have 10,000 or more enrollments of students. Counties with a big university(s) have high *OMRR*. This would explain that although these counties have pull characteristics of migration (people would like to have a higher education, therefore they move into these counties), they also have brain drain characteristics (higher educated people leave these places to have better life opportunities). Another spatial trend of relatively high *OMRR* follows generally poor socioeconomic conditions in such places as the Mississippi Delta region, most of Arkansas, northern Louisiana, the Piedmont region, southern Georgia, and southeastern Alabama. The Piedmont region is a geographic region in the eastern United States,

running some 600 miles (950 km) between New Jersey (north) and Alabama (south) and lying between the Appalachian Mountains (west) and the Atlantic Coastal Plain (east). Areas lying outside the southeastern Piedmont region are excluded in this study.

In addition, there is also a spatial trend of high *OMRR* that follows large cities. Figure 4.32 illustrates *OMRR* by coastal/non-coastal and rural/urban differences. Table 4.14 also reports rural and urban, as well as coastal and non-coastal differences, in *OMRR* by the 5 natural break classes.

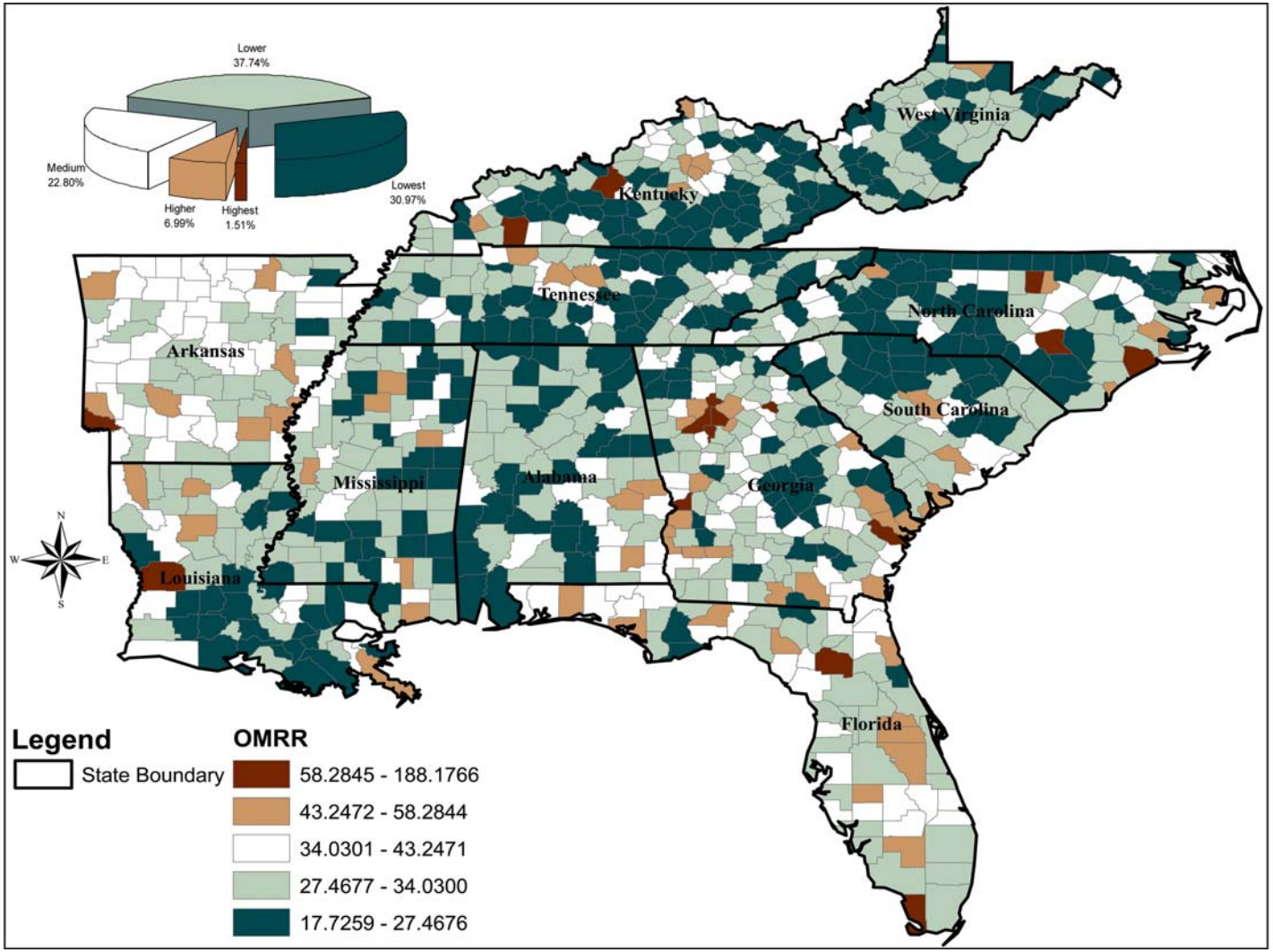


Figure 4.29 Out-Migrants per 1000 People for the Southeast Region, 1995 – 2000

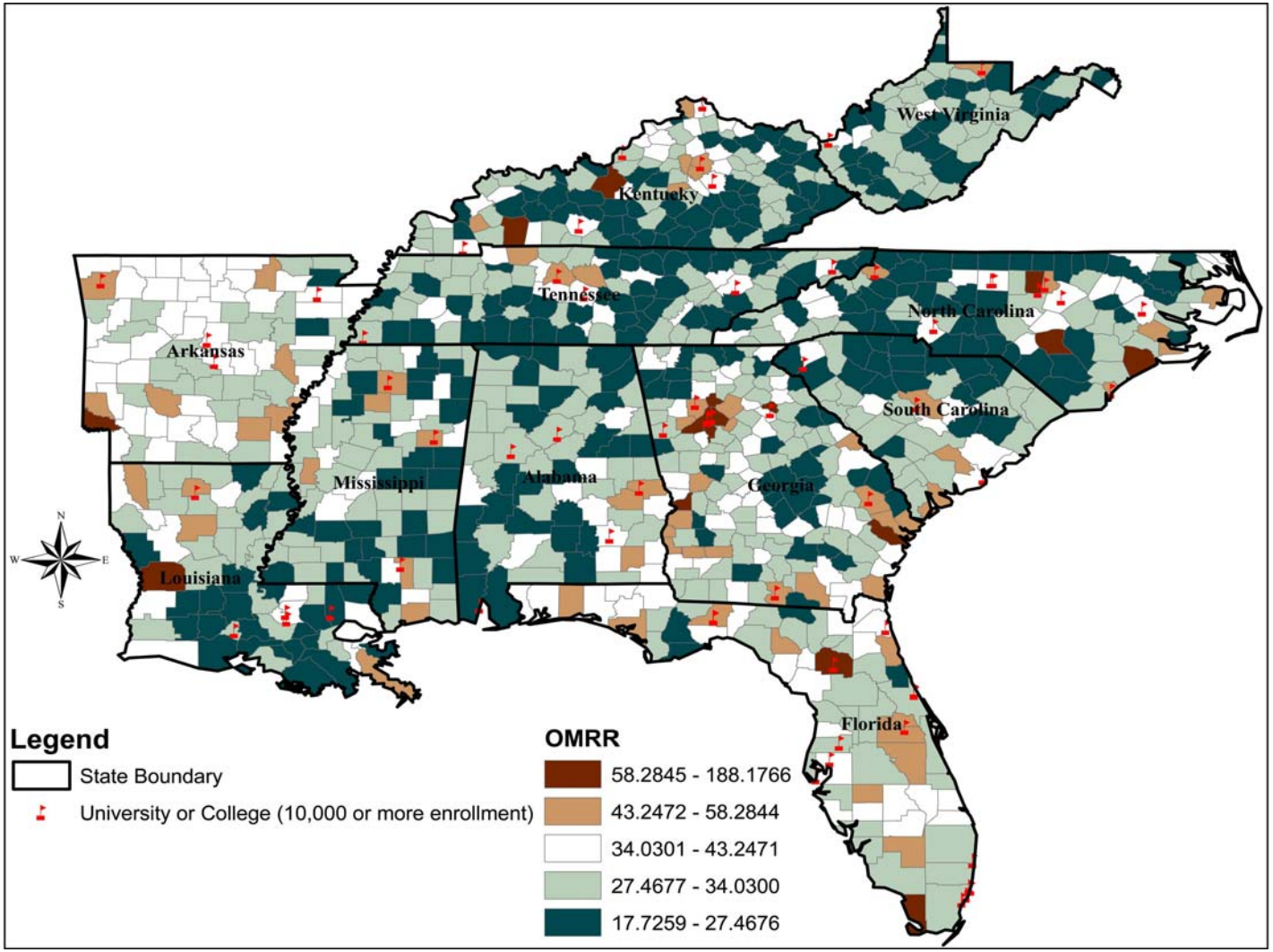


Figure 4.30 Spatial Distribution of Out-Migrants per 1000 People for the Southeast Region and Big Universities Influence, 1995 – 2000

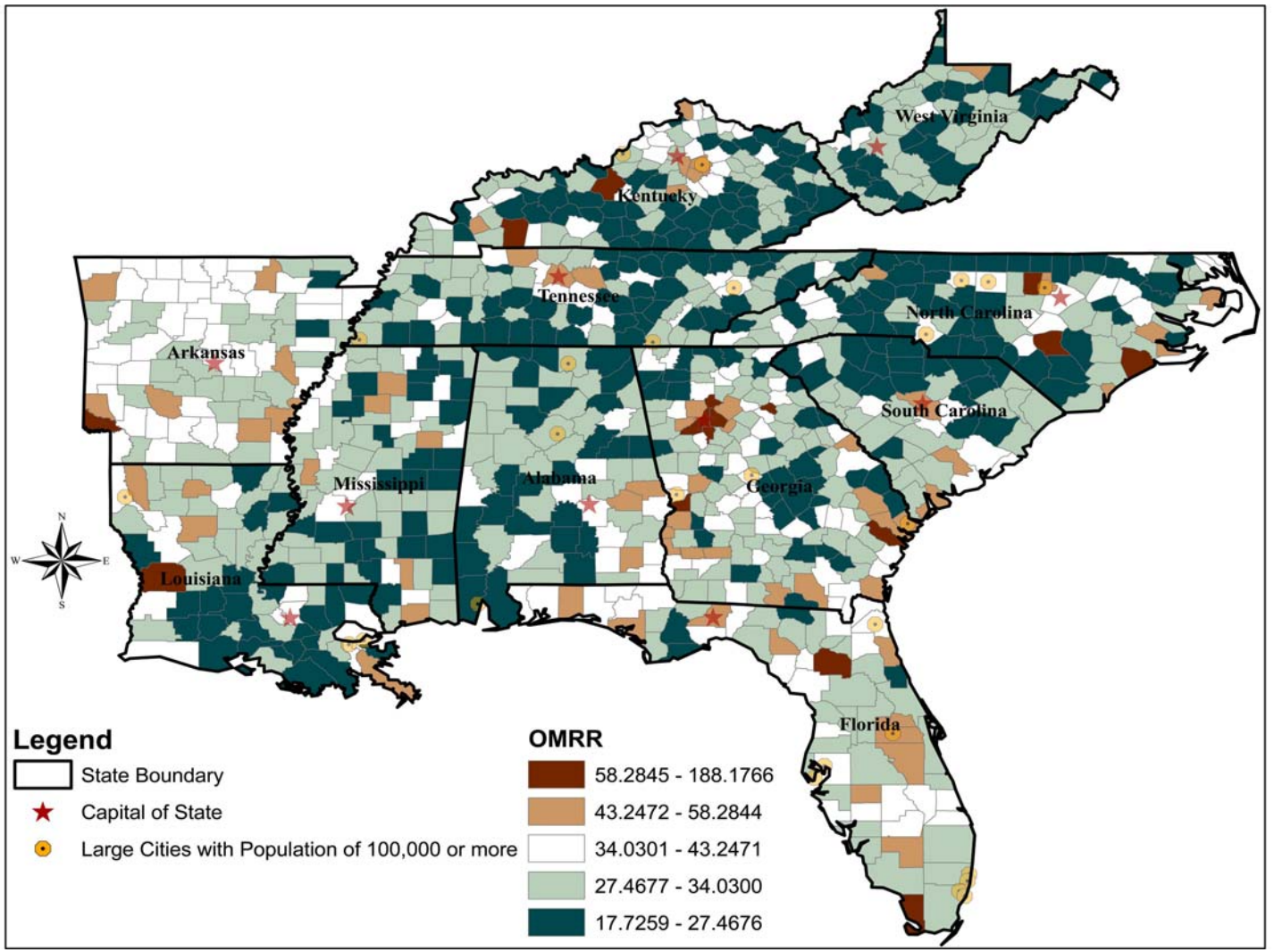


Figure 4.31 Spatial Distribution of Out-Migrants per 1000 People for the Southeast Region and State Capitals and Large Cities Influences, 1995 – 2000

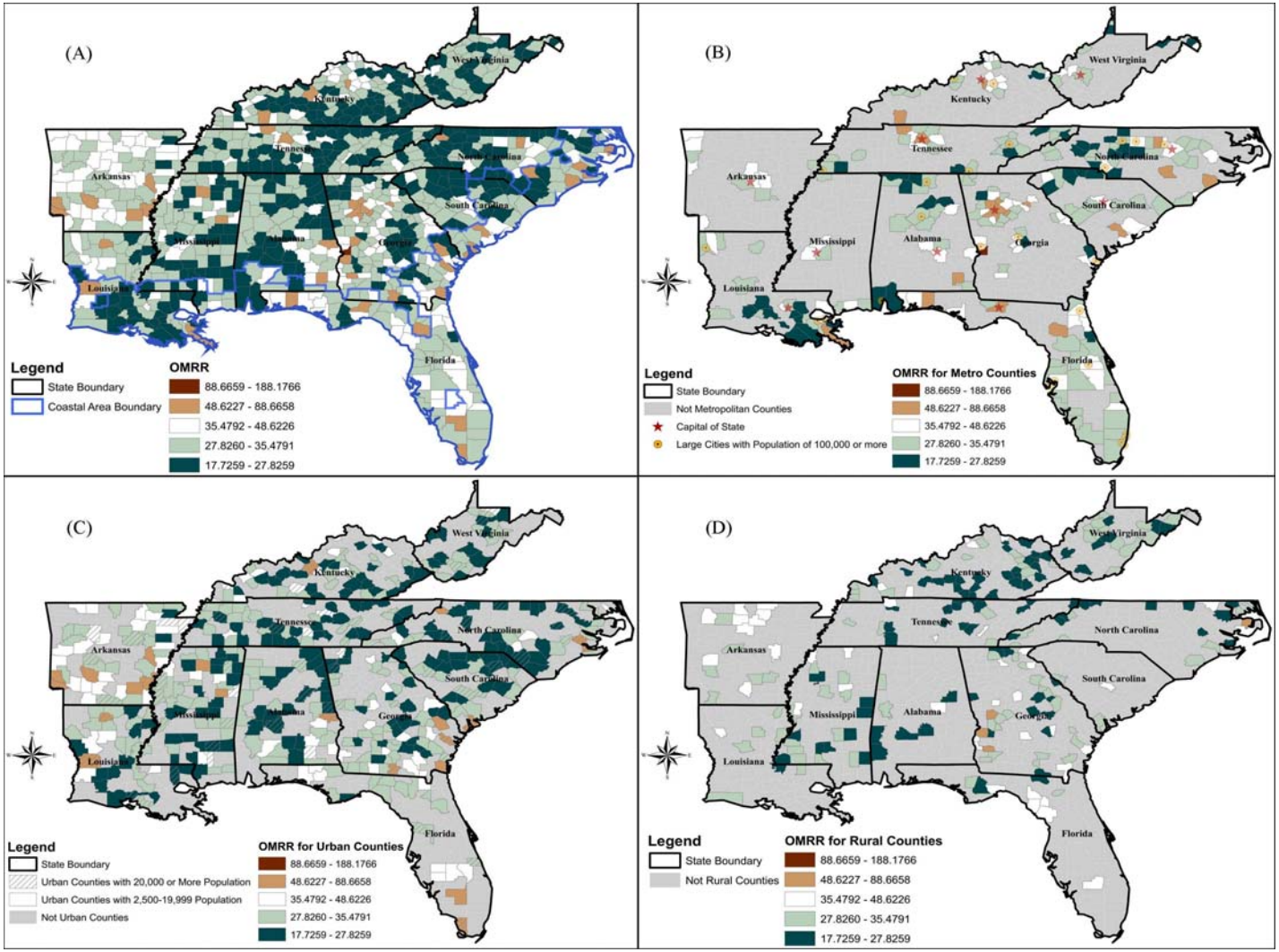


Figure 4.32 Coastal/Non-Coastal and Rural/Urban Differences in *OMRR* for the Southeast, 1995 -2000

Table 4.14 Descriptive Statistics for *OMRR* by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*OMRR*	
			Mean	Std. Dev.
Southeast	Total	930	32.2891	9.9140
[17.7259 - 188.1766]	Metropolitan	250	35.9175	13.5421
	Urban 4 & 5	62	35.8035	12.7734
	Urban 6 & 7	397	30.4521	7.1197
	Rural 8 & 9	221	30.4985	6.5758
	Coastal	206	33.7038	10.1598
	Non-Coastal	724	31.8866	9.8128
Highest *OMRR*	Total	14	77.6691	32.8511
[58.2845 - 188.1766]	Metropolitan	10	79.3735	38.7470
	Urban 4 & 5	3	75.4034	13.5660
	Urban 6 & 7	1	67.4229	-
	Rural 8 & 9	0	-	-
	Coastal	5	74.9703	10.7062
	Non-Coastal	9	79.1685	41.1010
Higher *OMRR*	Total	65	48.7901	4.0277
[43.2472 - 58.2844]	Metropolitan	31	47.6431	3.2750
	Urban 4 & 5	7	51.1552	4.3765
	Urban 6 & 7	18	49.7632	4.4283
	Rural 8 & 9	9	48.9549	4.6228
	Coastal	21	48.9495	3.9823
	Non-Coastal	44	48.7140	4.0928
Medium *OMRR*	Total	212	37.8313	2.7582
[34.0301- 43.2471]	Metropolitan	76	37.6192	2.6347
	Urban 4 & 5	14	39.6006	6.0005
	Urban 6 & 7	77	37.7216	2.2370
	Rural 8 & 9	45	37.8269	2.0675
	Coastal	54	37.3914	2.4671
	Non-Coastal	158	37.9816	2.8426
Lower *OMRR*	Total	351	30.5643	1.7772
[17.7259 - 34.0300]	Metropolitan	90	30.9281	1.7324
	Urban 4 & 5	23	30.5430	1.8321
	Urban 6 & 7	153	30.3795	1.8011
	Rural 8 & 9	85	30.5177	1.7391
	Coastal	71	30.7391	1.5716
	Non-Coastal	280	30.5200	1.8255
Lowest *OMRR*	Total	288	24.3813	2.2361
[17.7259 - 27.4676]	Metropolitan	43	24.7933	1.6505
	Urban 4 & 5	15	25.2416	2.1035
	Urban 6 & 7	148	24.1467	2.3807
	Rural 8 & 9	82	24.4313	2.2188
	Coastal	55	24.3377	2.3970
	Non-Coastal	233	24.3916	2.2017

4.2.2.3 IMRR and OMRR Comparisons

From Figures 4.28 and 4.32 metropolitan counties have the largest share of both high *IMMR* (46.51% - highest *IMRR* and 51.35% - higher *IMRR)* and high *OMRR* (71.43% - highest *OMRR* and 47.69% - higher *OMRR)*. Although rural counties have the second largest share of high *IMRR* (25.58% - highest *IMRR* and 21.62% - higher *IMRR*), rural counties also have the smallest share of high *OMRR* (0.00% - highest *OMRR* and 13.85% - higher *OMRR*). Urban counties with an urban population between 2,500 and 19,999 have the largest share of both low *IMMR* (53.31% - lowest *IMRR* and 53.44% lower *IMRR)* and low *OMRR* (51.39% - lowest *OMRR* and 43.59% lower *OMRR)*. Approximately, 73.55% of urban counties with an urban population between 2,500 and 19,999 are low *IMRR*, and 75.82% of urban counties with an urban population between 2,500 and 19,999 were low *OMRR*. Therefore, the majority of the urban population between 2,500 and 19,999 did not move from 1995 to 2000. Compared to coastal and non-coastal differences, coastal counties have higher *IMRR* and/or *OMRR* than non-coastal counties. When *IMRR* is always higher than *OMRR*, this creates a positive net in-migration.

4.3 Analysis for 2000 Social Development Factor

The level of 2000 social development is measured by the 2000 Human Development Index (HDI), which is the average of the educational, economic opportunity, and housing dimensions. The average human development index at the county level (county well-being index) by each component is reported in Table 4.15. Method of calculation is provided in Chapter III.

Table 4.15 The Average for the Human Development Index or County Well-Being Index, by RUC, 2000

RUC/Coastal /States	No of Counties	HDI	Human Development Index		
			ECON_00	EDUC_00	HOUS_00
Southeast	930	0.3620	0.5418	0.3787	0.1657
Metro	250	0.5039	0.7085	0.4969	0.3062
Urban 4 & 5	62	0.4109	0.5681	0.4414	0.2232
Urban 6 & 7	397	0.3098	0.4825	0.3331	0.1137
Rural	221	0.2818	0.4522	0.3091	0.0840
Coastal	206	0.3755	0.5426	0.4006	0.1834
Non-Coastal	724	0.3582	0.5415	0.3724	0.1606
Alabama	67	0.3272	0.5249	0.3109	0.1458
Arkansas	75	0.3948	0.5472	0.4371	0.2000
Florida	67	0.3964	0.6003	0.4304	0.1586
Georgia	159	0.3293	0.5009	0.3485	0.1384
Kentucky	120	0.3656	0.5690	0.4060	0.1217
Louisiana	64	0.3788	0.5264	0.3902	0.2197
Mississippi	82	0.3478	0.5155	0.3300	0.1979
North Carolina	100	0.3683	0.5374	0.3862	0.1812
South Carolina	46	0.4114	0.6332	0.3850	0.2158
Tennessee	95	0.3238	0.5197	0.3463	0.1052
West Virginia	55	0.4202	0.5691	0.4419	0.2496

The range of the county-level 2000 HDI's for the Southeast is from (a high) 0.8942 (Wake County, North Carolina) to (a low) 0.0725 in McDowell County, West Virginia, with a mean of 0.3620 (Table 4.15). For the 250 counties included in the metropolitan areas, the range is from 0.2421 (Edgecombe County, North Carolina) to 0.8942 (Wake County, North Carolina) with a mean of 0.5039. For the 62 urban counties with an urban population of 20,000 or more, the mean is 0.3098 with a range of 0.1956 (Halifax County, North Carolina) to 0.7466 (Beaufort County, South Carolina). For the 397 counties included in the urban counties with an urban population of 2,500 to 19,999, the range is from 0.0725 (McDowell County, West Virginia) to 0.5884 (Lamar County, Mississippi) with a mean of 0.3098. For the 221 completely rural counties or urban counties with an urban population of less than 2,500, the mean is 0.2818 with a range of 0.0857 (Lake County, Tennessee) to 0.5378 (Spencer County, Kentucky). For the 206 coastal counties, the range is from 0.1270 (Tyrrell County, North Carolina) to .0.7791 (St. Tammany County, Louisiana) with a mean of 0.3755. For the 724 non-coastal counties, the mean is 0.3582 with a range of 0.0857 (Lake County, Tennessee) to 0.5378 (Spencer County, Kentucky).

4.3.1 2000 Economic Opportunity Dimension Index

Illustrated in Table 4.15, the Southeast region's average economic opportunity dimension index at the county level (*ECON_00*) is 0.5418 with a range of 0 (McDowell County, West Virginia and Holmes County, Mississippi) to 1 (De Soto County, Mississippi, Shelby County, Alabama, and Williamson County, Tennessee). The economic opportunity dimension index 1 represents the highest level of economic growth

opportunity dimension (high 1999 median household income, low percentage of families living below the poverty level in 1999, and low average monthly unemployment rate), while 0 represents the lowest level in the corresponding state. The range of numbers is significant in that they serve as a focus on economic growth towards human development or well-being. Average *ECON_00* for counties in the metropolitan areas and urban counties with an urban population of 20,000 or more are higher than the Southeast average. *ECON_00* for urban counties with an urban population below 20,000 and completely rural counties were smaller than the Southeast average. The states of South Carolina (highest), Florida, West Virginia, Kentucky, and Arkansas had above the Southeast average *ECON_00;* the states of Georgia (lowest), Mississippi, Tennessee, Alabama, Louisiana, and North Carolina had below the Southeast average *ECON_00*. Therefore, these states have a lower economic opportunity dimension, which leads to lower well-being.

Figure 4.33, Figure 4.34, and Figure 4.35 illustrate the economic opportunity dimension index (*ECON_00*), the geographic distribution of *ECON_00*, and rural/urban & coastal/non-coastal differences in *ECON_00*. *ECON_00* was classified into 5 classes using the natural break classification schemes. From a total of 930 counties, 30% (8.17% - highest *ECON_00* and 21.83% - higher *ECON_00*) were in the high *ECON_00* class with a range of 0.6365 to 1.000, 31.83% belonged to the medium *ECON_00* class with a range of 0.4928 to 0.6364, and 38.17% (24.73% - lower *ECON_00* and 13.44% - lowest *ECON_00*) fitted in the low *ECON_00* class with a range of 0.000 to 0.4927. The low *ECON_00* class includes 38.17% of counties in the Southeast means it has a significant

high amount which can contribute to having a lesser economic growth and lower well-being.

The characteristics of the *ECON_00* geographic distribution counties in the metropolitan areas and their neighbor urban counties are high *ECON_00* – especially for counties that were close to interstate highways. This would signify that interstate highways do contribute to economic growth. As shown in Table 4.16, on average, the high *ECON_00* class has 72.40% of the counties in MSAs, 30.65% of the urban 4 & 5 counties, 14.11% of the urban 6 & 7 counties, and 10.41% of the completely rural counties or the urban counties with a population less than 2,500. On average, the medium *ECON_00* class consists of 18.80% of the metropolitan counties, 48.39% of urban 4 & 5 counties, 37.53% of the urban 6 &7 counties, and 31.67% of the rural 8 & 9 counties. Therefore, it appears that counties in MSA and urban 4 & 5 counties have a higher economic opportunity dimension. However, most of rural and southern urban counties have low *ECON_00*. Low *ECON_00* counties were located a further distance from interstate highways illustrating a dependency. On average, in the low *ECON_00* class, 8.80% of the metropolitan counties, 20.97% of the urban 4 & 5 counties, 48.36% of the urban 6 & 7 counties, and 57.92% of the rural 8 & 9 counties are included. Delta (AR-MS-LA), Piedmont, southern Georgia, southern Alabama, eastern Kentucky, southern West Virginia, southeast North Carolina, southeast South Carolina, northern Louisiana, and southern Arkansas are states with predominately rural and urban counties with significant distance from the interstate highways; therefore, they have low *ECON_00* (Figure 4.35). Their well-being is affected – being lower.

Although the characteristics of the spatial trend for *ESTGRO* and *EMPGRO* follow interstate highways, the large cities do not have high *ESTGRO* and *EMPGRO*. Neighboring counties of the large cities have high *ESTGRO* and *EMPGRO*. However, the spatial trend of *ECON_00* followed interstate highways, rural urban continuum, and large cities (Figure 4.34).

Although *ECON_00* in the coastal counties is lower than *ECON_00* in the non-coastal counties in the highest, the medium, and the lower classes of *ECON_00*, *ECON_00* in the coastal counties is higher than *ECON_00* in the non-coastal counties in the high and the lowest classes of *ECON_00*. *ECON_00* in the coastal counties is slightly higher than the southeast region average and non-coastal counties' average. Being slightly higher illustrates that being a coastal county does give a slight advantage in terms of economic growth and the attraction of population growth through migration. However, interstates and large cities play a main role, as well as other factors such as age distribution and racial distribution. In the high *ECON_00* class, 32.52% are the coastal counties and 29.28% are non-coastal counties. The low *ECON_00* class have 44.17% of the coastal counties and 36.46% of the non-coastal counties.

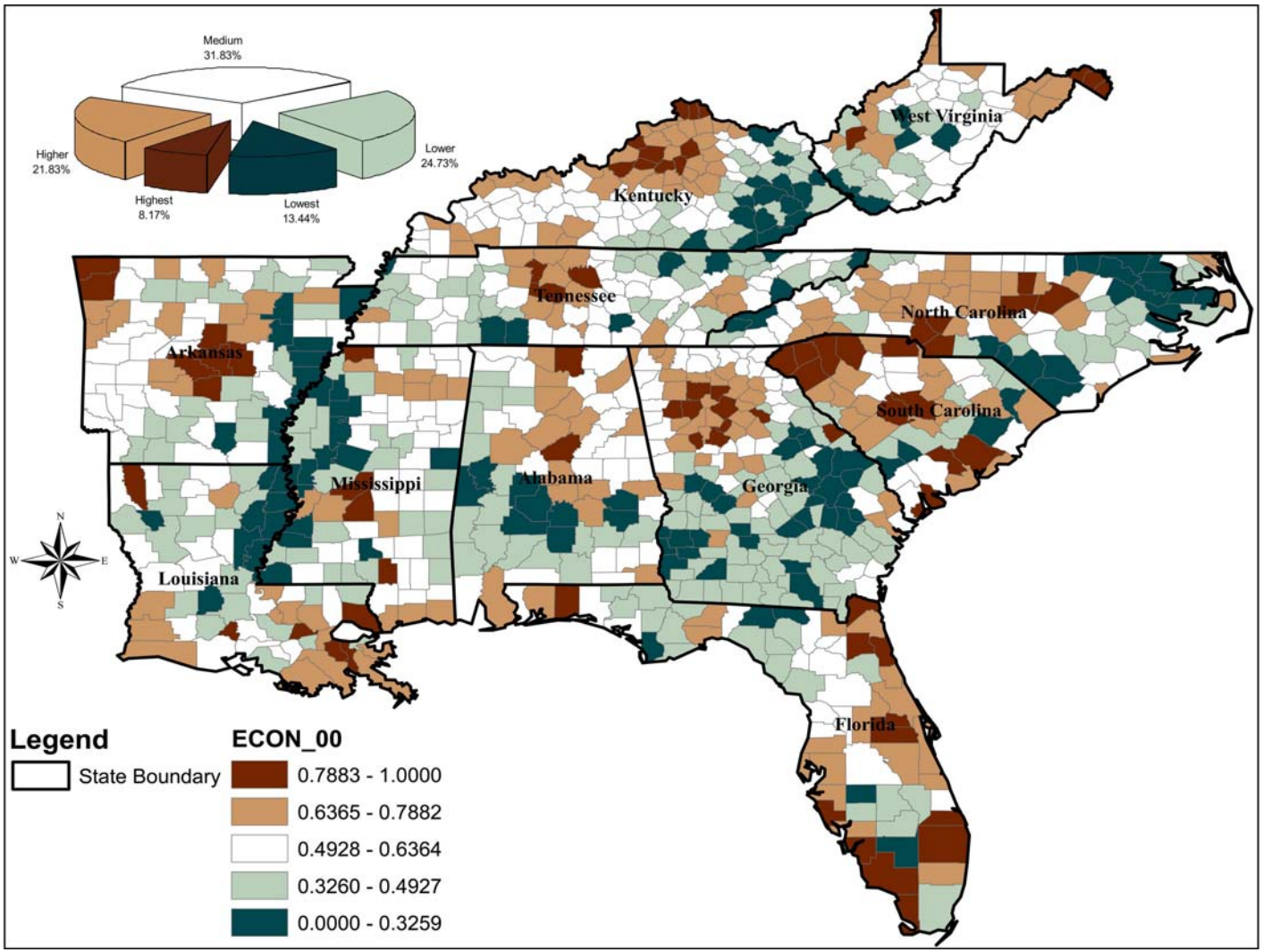


Figure 4.33 Economic Opportunity Dimension Index for the Southeast Region, 2000

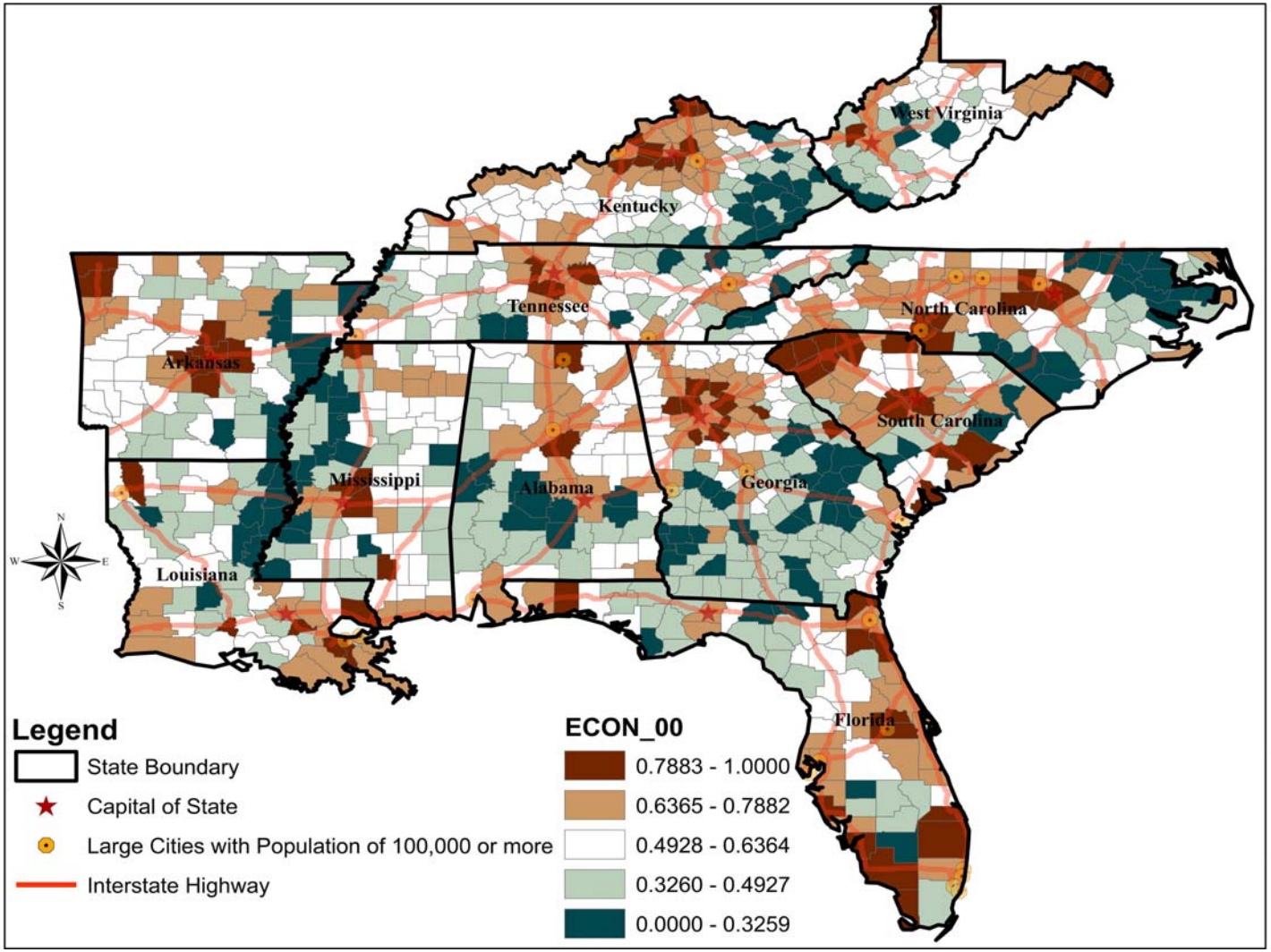


Figure 4.34 Spatial Distribution of Economic Opportunity Dimension Index for the Southeast Region, 2000

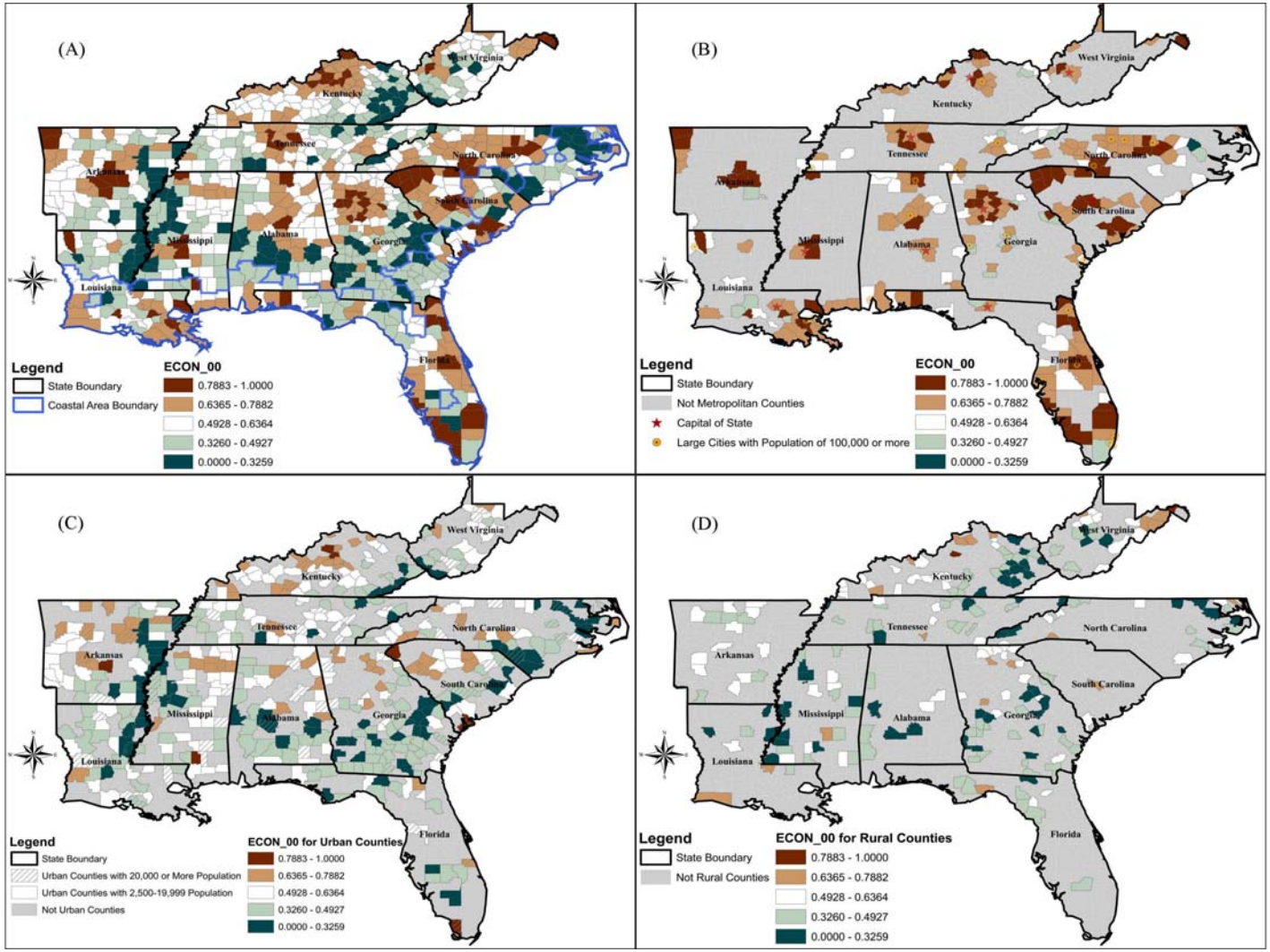


Figure 4.35 Coastal/Non-Coastal and Rural/Urban Differences in Economic Opportunity Dimension Index for the Southeast, 2000

Table 4.16 Descriptive Statistics for *ECON_00* by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*ECON_00*	
			Mean	Std. Dev.
Southeast	Total	930	0.5418	0.1844
[0.0000 - 1.0000]	Metropolitan	250	0.7085	0.1411
	Urban 4 & 5	62	0.5681	0.1485
	Urban 6 & 7	397	0.4825	0.1536
	Rural 8 & 9	221	0.4522	0.1618
	Coastal	206	0.5426	0.1940
	Non-Coastal	724	0.5415	0.1817
Highest *ECON_00*	Total	76	0.8706	0.0678
[0.7883 - 1.0000]	Metropolitan	67	0.8746	0.0695
	Urban 4 & 5	2	0.9041	0.0638
	Urban 6 & 7	5	0.8150	0.0189
	Rural 8 & 9	2	0.8412	0.0067
	Coastal	21	0.8675	0.0724
	Non-Coastal	55	0.8718	0.0667
Higher *ECON_00*	Total	203	0.7070	0.0420
[0.6365 - 0.7882]	Metropolitan	114	0.7185	0.0409
	Urban 4 & 5	17	0.6904	0.0423
	Urban 6 & 7	51	0.6897	0.0352
	Rural 8 & 9	21	0.6997	0.0456
	Coastal	46	0.7275	0.0421
	Non-Coastal	157	0.7010	0.0402
Medium *ECON_00*	Total	296	0.5678	0.0392
[0.4928 - 0.6364]	Metropolitan	47	0.5764	0.0322
	Urban 4 & 5	30	0.5715	0.0390
	Urban 6 & 7	149	0.5642	0.0400
	Rural 8 & 9	70	0.5684	0.0413
	Coastal	48	0.5590	0.0396
	Non-Coastal	248	0.5696	0.0389
Lower *ECON_00*	Total	230	0.4217	0.0466
[0.3260 - 0.4927]	Metropolitan	21	0.4399	0.0456
	Urban 4 & 5	9	0.4165	0.0481
	Urban 6 & 7	126	0.4195	0.0466
	Rural 8 & 9	74	0.4208	0.0464
	Coastal	65	0.4161	0.0424
	Non-Coastal	165	0.4239	0.0481
Lowest *ECON_00*	Total	125	0.2329	0.0762
[0.0000 - 0.3259]	Metropolitan	1	0.3013	-
	Urban 4 & 5	4	0.1964	0.0561
	Urban 6 & 7	66	0.2333	0.0821
	Rural 8 & 9	54	0.2338	0.0705
	Coastal	26	0.2392	0.0654
	Non-Coastal	99	0.2312	0.0791

4.3.2 2000 Education Dimension Index

As shown in Table 4.15, the southeast region's average education dimension index at the county (*EDUC_00*) level was 0.3787 with a range of 0.0076 (Lake County, Tennessee) to 0.9574 (Williamson County, Tennessee). Zero represents a very low educational dimension, while 1 represents a very high educational dimension index. The average education dimension index at the county level for the Southeast is relatively low, suggesting that the percentage of persons aged 25 and older who are high school graduates and college graduates is relatively low; the percentage of total population that enrolled in elementary and high school is low as well. According to the new economic growth theory, the need for higher human capital (higher education, higher vocational skills, research) is a requirement of economic development. This would suggest that high labor skills are in demand, but the quality of labor supply or education dimension of the population in the Southeast is not great.

Average *EDUC_00* for counties in the metropolitan areas and urban counties with an urban population of 20,000 or more is higher than the Southeast average. *EDUC_00* for urban counties with an urban population below 20,000 and completely rural counties are smaller than the Southeast average. This is obvious since the Southeast average is relatively low and metropolitan areas as well as urban 4 & 5 counties can offer better education opportunities that rural areas can not offer. The states of West Virginia (highest), Arkansas, Florida, Kentucky, Louisiana, North Carolina, and South Carolina had above the Southeast average *EDUC_00;* Alabama (lowest), Mississippi, Tennessee, and Georgia had below the Southeast average *EDUC_00*. It would appear that racial

composition also plays a role in the education dimension index since Mississippi, Alabama, Georgia, and Tennessee are the most diversified states.

Figure 4.36, Figure 4.37, Figure 4.38, and Figure 4.39 illustrate the education dimension index (*EDUC_00*), the geographic distribution of *EDUC_00*, rural/urban, and coastal/non-coastal differences in *EDUC_00*. *EDUC_00* is classified into 5 classes using the natural break classification schemes. From a total of 930 counties, 31.51% (9.14% - highest *EDUC_00* and 22.37% - higher *EDUC_00*) are in the high *EDUC_00* class with a range of 0.4317 to 0.9574, 27.53% belong to the medium *EDUC_00* class with a range of 0.3312 to 0.4316, and 40.97% (27.74% - lower *EDUC_00* and 13.23% - lowest *EDUC_00*) fit in the low *EDUC_00* class with a range of 0.0076 to 0.3311. The approximate 41% of the total counties being in the low EDUC_00 class would validate the Southeast having a region's average education dimension index at the county (*EDUC_00*) level of 0.3787.

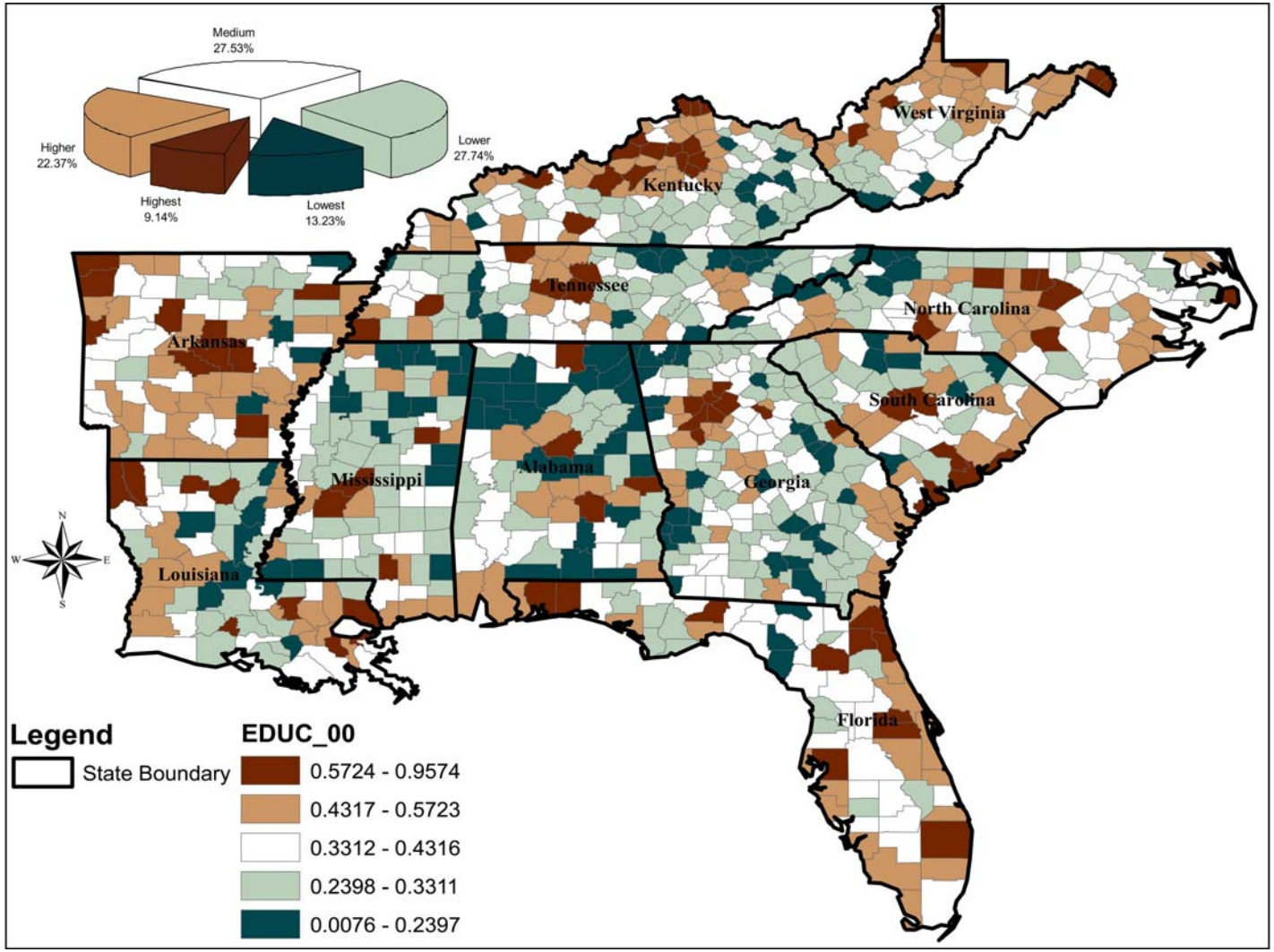


Figure 4.36 Education Dimension Index for the Southeast Region, 2000

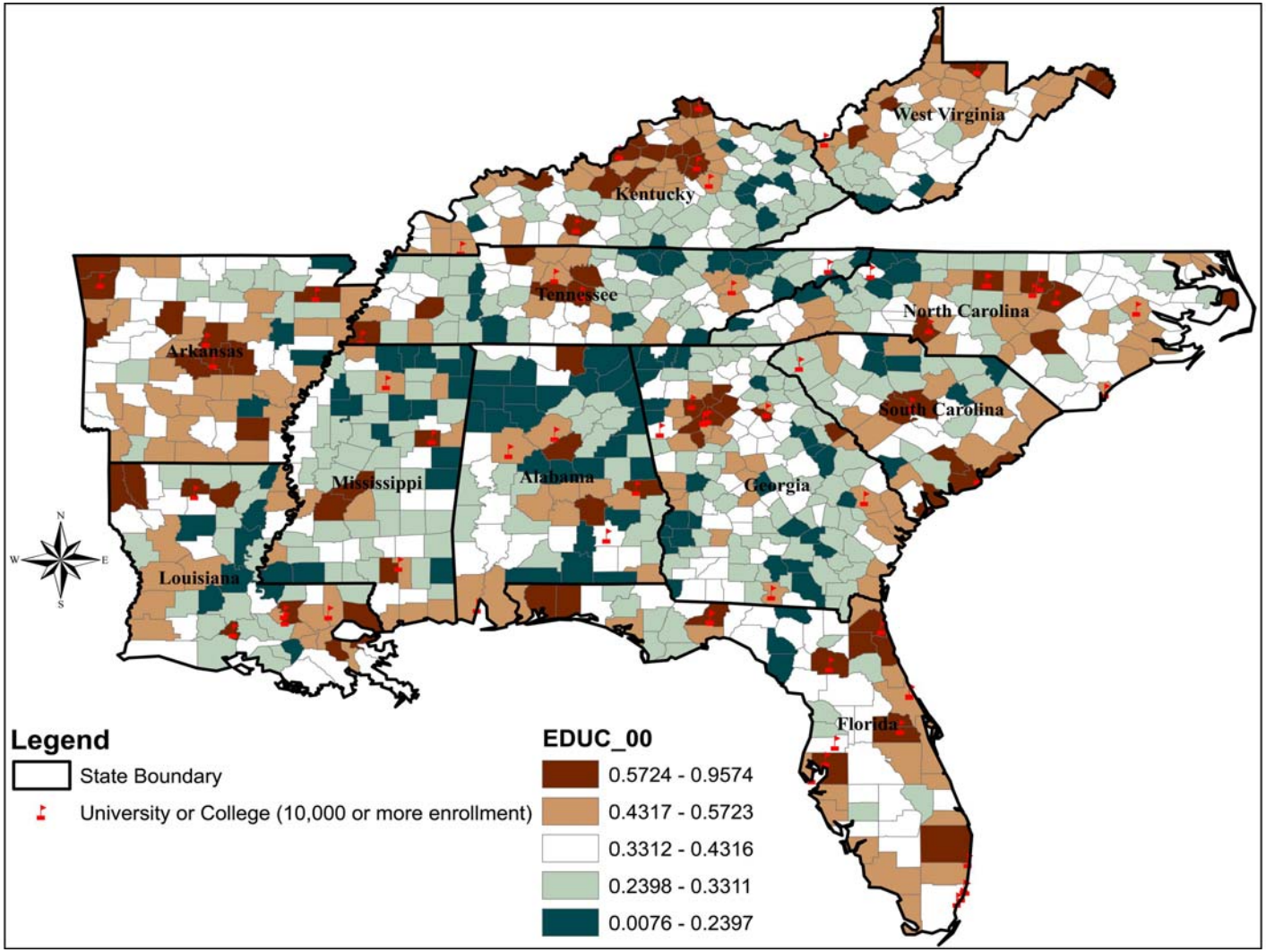


Figure 4.37 Spatial Distribution of the Education Dimension Index for the Southeast Region and Big Universities Influence, 2000

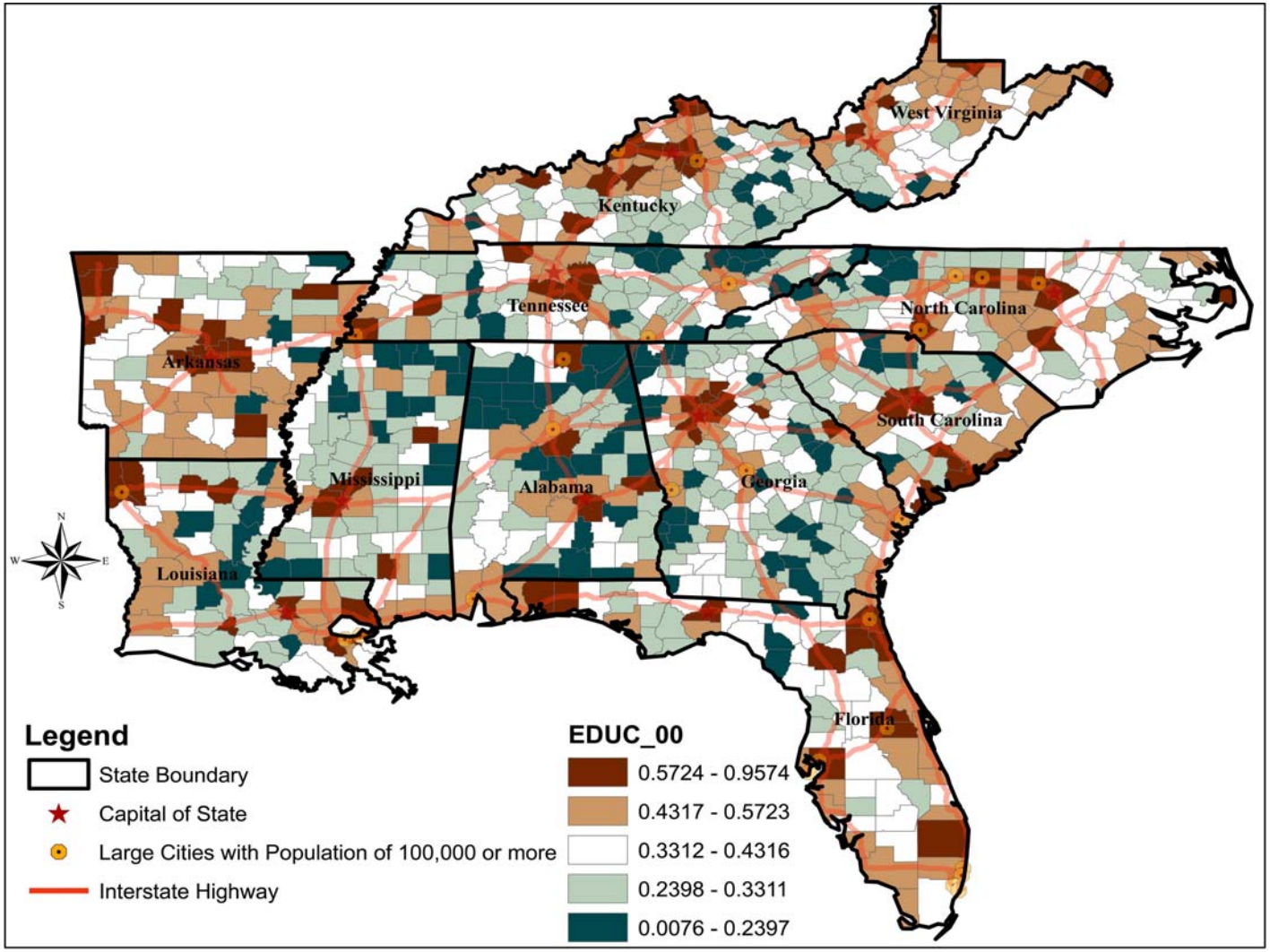


Figure 4.38 Spatial Distribution Education Dimension Index for the Southeast Region and Interstates, State Capitals, and Large Cities Influences, 2000

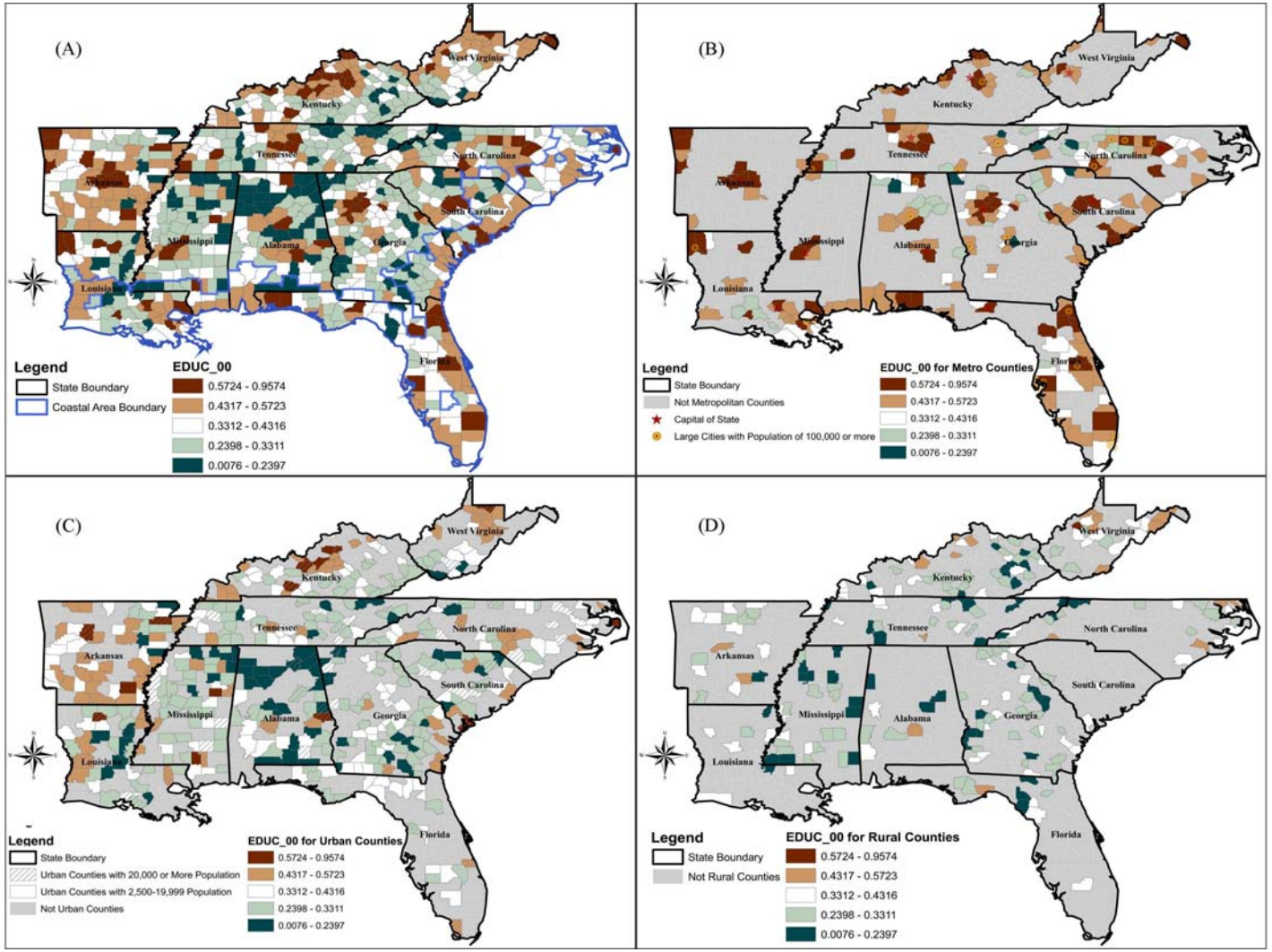


Figure 4.39 Coastal/Non-Coastal and Rural/Urban Differences in Education Dimension Index for the Southeast, 2000

Table 4.17 Descriptive Statistics for *EDUC_00* by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*EDUC_00*	
			Mean	Std. Dev.
Southeast [0.0076-0.9574]	Total	930	0.3787	0.1362
	Metropolitan	250	0.4969	0.1431
	Urban 4 & 5	62	0.4414	0.1178
	Urban 6 & 7	397	0.3331	0.0973
	Rural 8 & 9	221	0.3091	0.0931
	Coastal	206	0.4006	0.1242
	Non-Coastal	724	0.3724	0.1388
Highest *EDUC_00* [0.5724-0.9574]	Total	85	0.6623	0.0750
	Metropolitan	69	0.6711	0.0783
	Urban 4 & 5	9	0.6372	0.0511
	Urban 6 & 7	6	0.6087	0.0253
	Rural 8 & 9	1	0.6068	-
	Coastal	21	0.6469	0.0618
	Non-Coastal	64	0.6674	0.0786
Higher *EDUC_00* [0.4317-0.5723]	Total	208	0.4896	0.0428
	Metropolitan	103	0.5039	0.0435
	Urban 4 & 5	23	0.4870	0.0366
	Urban 6 & 7	61	0.4734	0.0372
	Rural 8 & 9	21	0.4693	0.0370
	Coastal	56	0.4891	0.0394
	Non-Coastal	152	0.4898	0.0441
Medium *EDUC_00* [0.3312-0.4316]	Total	256	0.3750	0.0288
	Metropolitan	42	0.3807	0.0304
	Urban 4 & 5	21	0.3829	0.0300
	Urban 6 & 7	123	0.3724	0.0292
	Rural 8 & 9	70	0.3738	0.0262
	Coastal	67	0.3688	0.0273
	Non-Coastal	189	0.3772	0.0290
Lower *EDUC_00* [0.2398-0.3311]	Total	258	0.2882	0.0261
	Metropolitan	27	0.2980	0.0250
	Urban 4 & 5	6	0.3000	0.0315
	Urban 6 & 7	148	0.2890	0.0261
	Rural 8 & 9	77	0.2823	0.0250
	Coastal	45	0.2968	0.0257
	Non-Coastal	213	0.2864	0.0259
Lowest *EDUC_00* [0.0076-0.2397]	Total	123	0.1924	0.0410
	Metropolitan	9	0.2190	0.0165
	Urban 4 & 5	3	0.1959	0.0635
	Urban 6 & 7	59	0.1890	0.0418
	Rural 8 & 9	52	0.1914	0.0412
	Coastal	17	0.2055	0.0249
	Non-Coastal	106	0.1903	0.0428

The *EDUC_00* tends to be high in metropolitan areas and their neighboring urban counties, especially the counties that are close to interstate highways. Most of the rural and southern urban counties have low *EDUC_00*. Low *EDUC_00* counties are located a further distance from the interstate highways. The *EDUC_00* dimension is positively correlated with interstate highways, rural urban continuum, and large cities. This is similar to the spatial distribution of *ECON_00*. (Figure 4.38) High *EDUC_00* also tends to occur in counties that have large universities or colleges with 10,000 or more enrolled students and if the county is coastal. (Figure 4.37)

4.3.3 2000 Housing Dimension Index

Lower housing dimension indicators close to zero represent the lower total number of housing units, the lower number of owner-occupied housing units, and the lower median value of owner-occupied housing units. Higher housing dimension indicators represent numerical values closer to 1. As shown in Table 4.15, the southeast region's average housing dimension index at the county level (*HOUS_00*) is quite low at 0.1657, with a range of 0.000 (Taliaferro County, Georgia) to 0.9910 (Fulton County, Georgia). The housing dimension index is a measurement of the quality of life dimension of social development by neighborhood areas. Lee and Murie (1997) argue that the quality of housing is not the result of poverty but a factor that contributes to the problem of social integration and development. They also argue that low quality housing and homelessness contribute to what they refer to as "social exclusion." Social exclusion refers to the characteristic of being generally deprived of any stake or influence in their social surroundings (Lee, Peter and Alan Murie, 1997). The pattern of deprivation

coincides with patterns of housing tenure. Housing tenure and deprivation are strongly related to unemployment, poverty, and income or economic deprivation (Dean, John P. , 1949, Hunt, Bradford D., 1997).

The average *HOUS_00* for counties in the metropolitan areas and urban counties with an urban population greater than 20,000 is higher than the Southeast average; *HOUS_00* for urban counties with an urban population below 20,000 and completely rural counties are smaller than the Southeast average. The states of West Virginia (highest), Louisiana, South Carolina, Arkansas, Mississippi, and North Carolina have above the Southeast average *HOUS_00;* Tennessee (lowest), Kentucky, Georgia, Alabama, and Florida have below the Southeast average *HOUS_00*. Florida's low housing index can be attributed to a high median value of owner-occupied housing, as well as a low number of owner-occupied housing units, and possibly coastal factors, as well as climate, being hurricane territory (see coastal section for more details). Tennessee has similar problems to Florida in terms of housing dimension indicators. Georgia's, Kentucky's, and Alabama's low housing indices are attributed to having high percentages or rural counties and few numbers of concentrated metropolitan areas. Even though the Atlanta, Georgia, MSA is the largest MSA in the Southeast, Georgia has the highest number of counties, as well as a percentage of rural counties and urban 6 & 7 counties.

Figure 4.40, Figure 4.41, and Figure 4.42 illustrate the economic opportunity dimension index (*HOUS_00*), *HOUS_00* the geographic distribution, and rural/urban & coastal/non-coastal differences in *HOUS_00*. *HOUS_00* is classified into 5 classes using the natural break classification schemes.

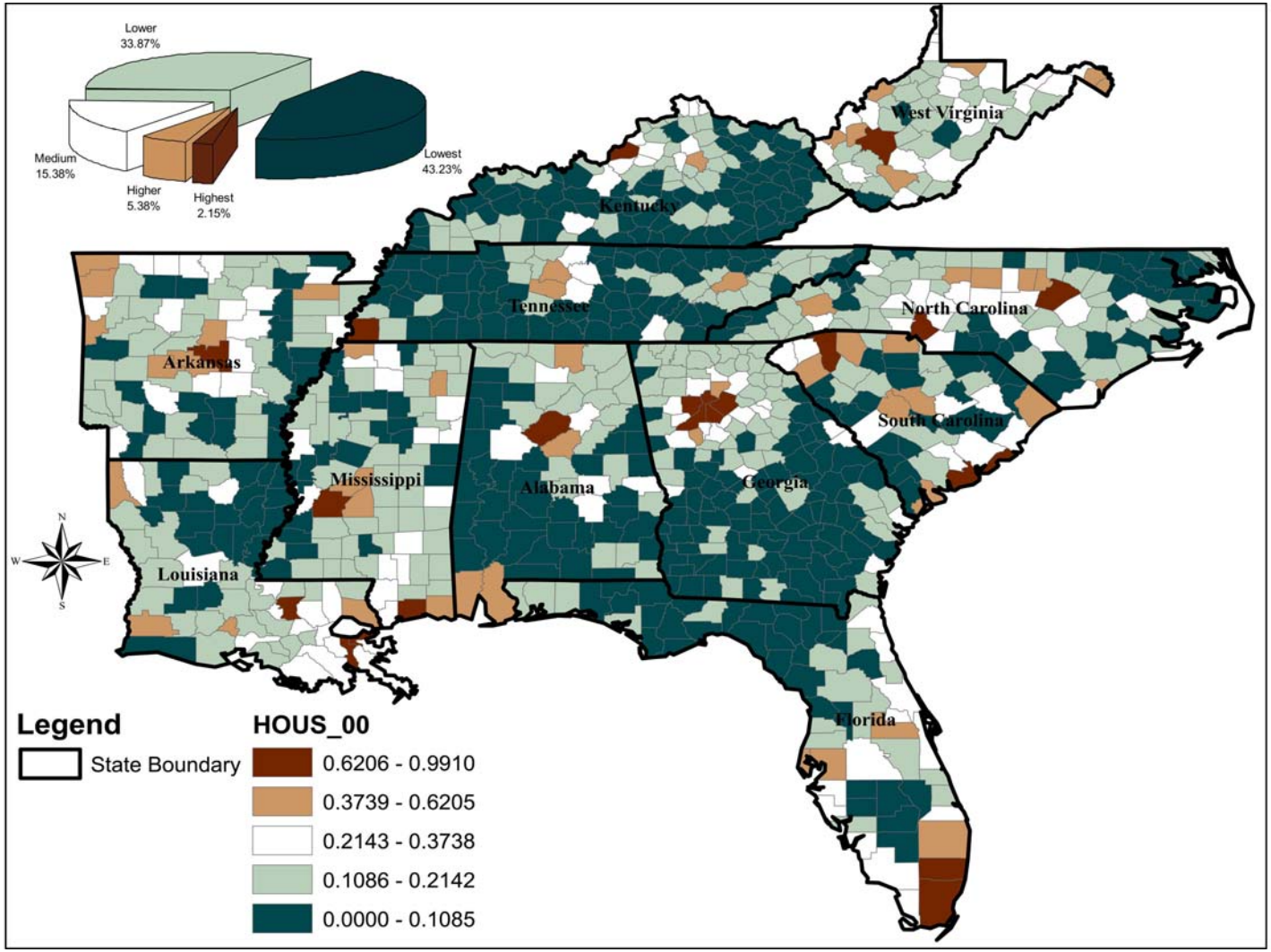


Figure 4.40 Housing Dimension Index for the Southeast Region, 2000

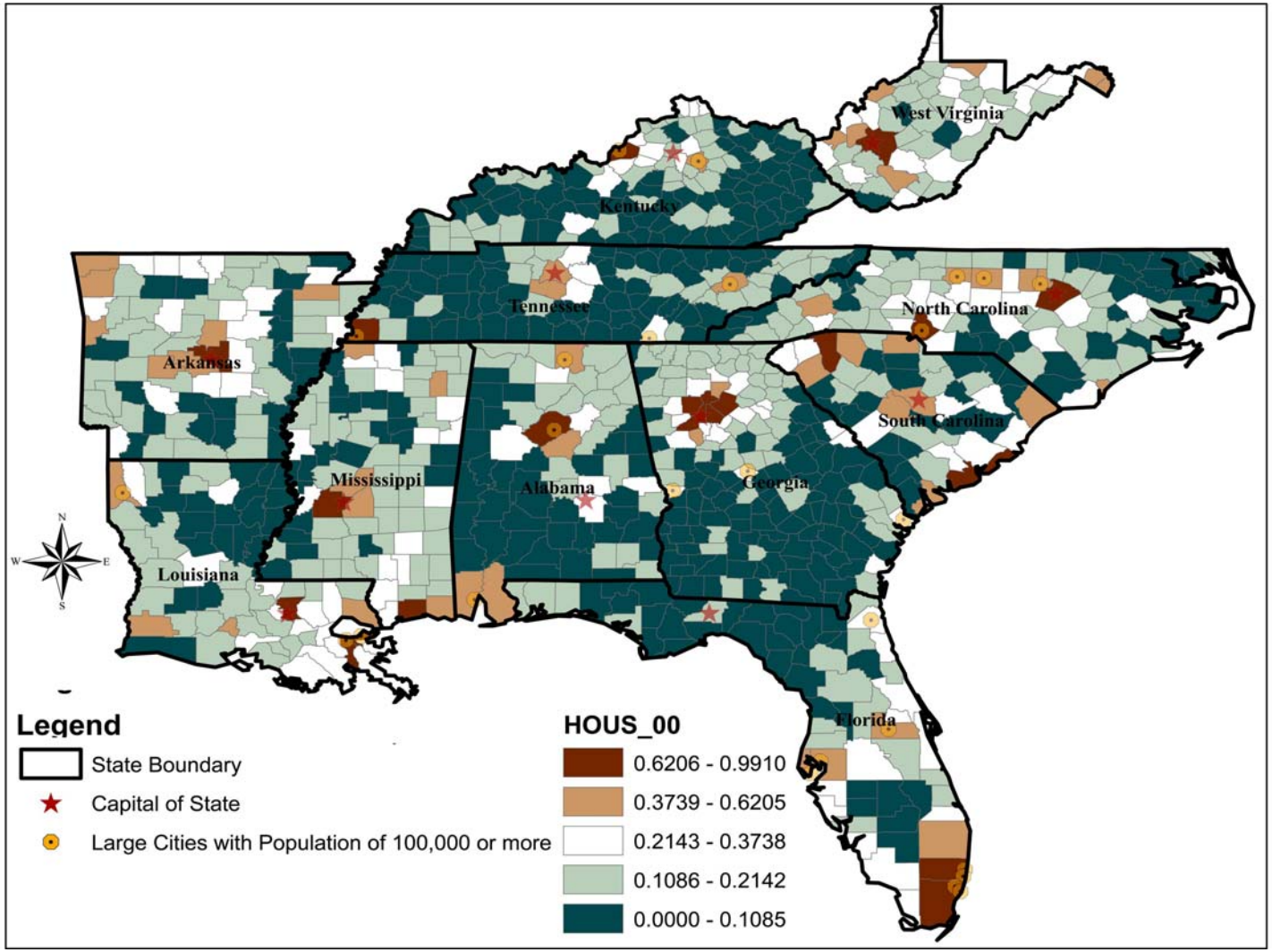


Figure 4.41 Spatial Distribution of the Housing Dimension Index for the Southeast Region and State Capitals and Large Cities Influences, 2000

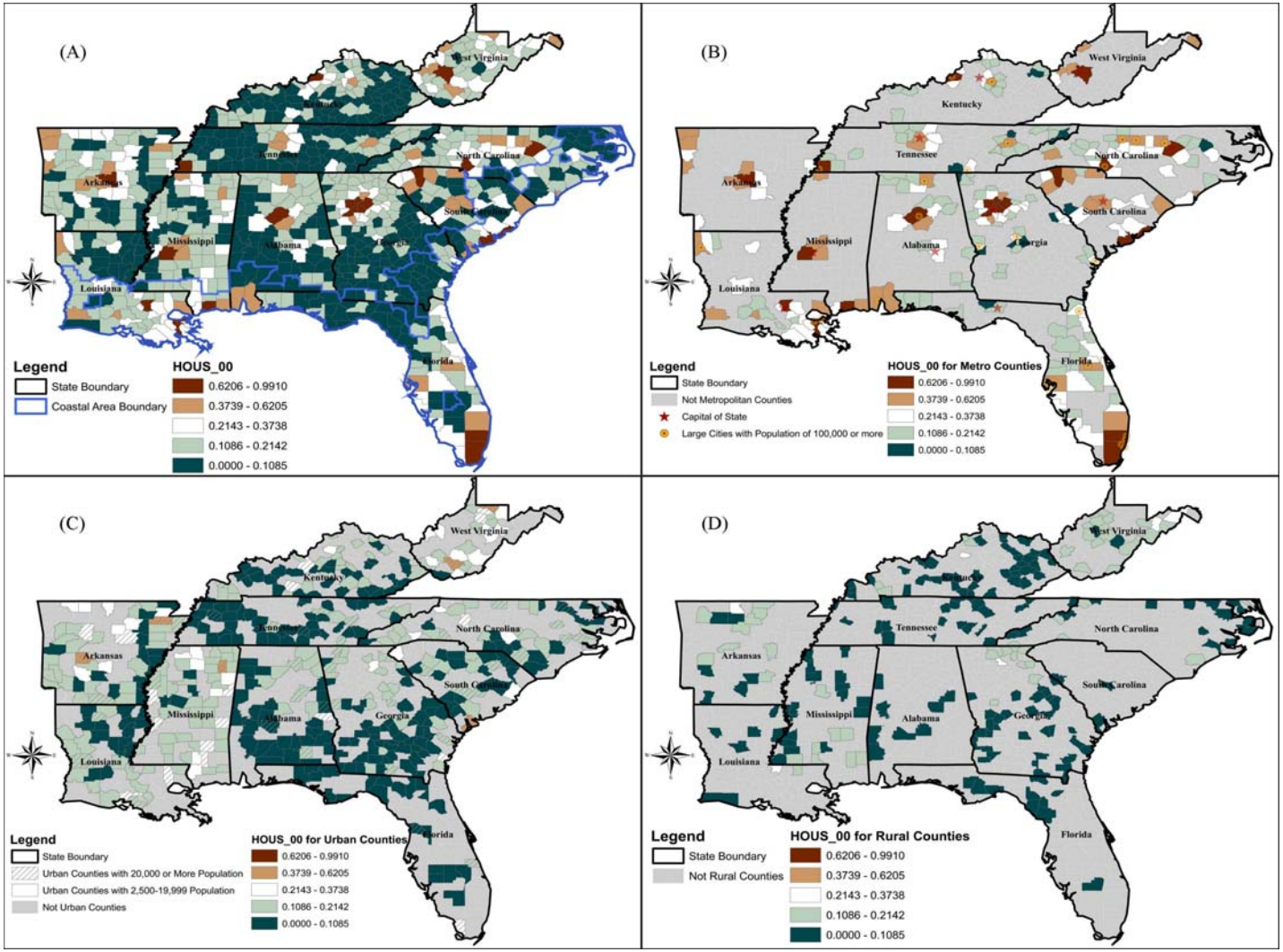


Figure 4.42 Coastal/Non-Coastal and Rural/Urban Differences in Housing Dimension Index for the Southeast, 2000

Table 4.18 Descriptive Statistics for *HOUS_00* by 5 Classes and by Rural/Urban and Coastal/Non-Coastal Differences

Classification	RUC/Coastal	No. of Counties	*HOUS_00*	
			Mean	Std. Dev.
Southeast	Total	930	0.1657	0.1492
[0.0000 - 0.9910]	Metropolitan	250	0.3062	0.1977
	Urban 4 & 5	62	0.2232	0.1093
	Urban 6 & 7	397	0.1137	0.0677
	Rural 8 & 9	221	0.0840	0.0569
	Coastal	206	0.1834	0.1680
	Non-Coastal	724	0.1606	0.1431
Highest *HOUS_00*	Total	20	0.8163	0.0778
[0.6206 - 0.9910]	Metropolitan	20	0.8163	0.0778
	Urban 4 & 5	-	-	-
	Urban 6 & 7	-	-	-
	Rural 8 & 9	-	-	-
	Coastal	7	0.7751	0.0596
	Non-Coastal	13	0.8384	0.0793
Higher *HOUS_00*	Total	50	0.4801	0.0713
[0.3739 - 0.6205]	Metropolitan	44	0.4836	0.0725
	Urban 4 & 5	6	0.4548	0.0608
	Urban 6 & 7	-	-	-
	Rural 8 & 9	-	-	-
	Coastal	13	0.4947	0.0836
	Non-Coastal	37	0.4750	0.0670
Medium *HOUS_00*	Total	143	0.2771	0.0448
[0.2143 - 0.3738]	Metropolitan	85	0.2778	0.0442
	Urban 4 & 5	18	0.2973	0.0462
	Urban 6 & 7	33	0.2701	0.0461
	Rural 8 & 9	7	0.2504	0.0196
	Coastal	40	0.2842	0.0456
	Non-Coastal	103	0.2744	0.0444
Lower *HOUS_00*	Total	315	0.1549	0.0294
[0.1086 - 0.2142]	Metropolitan	88	0.1623	0.0304
	Urban 4 & 5	32	0.1639	0.0291
	Urban 6 & 7	141	0.1513	0.0278
	Rural 8 & 9	54	0.1470	0.0291
	Coastal	59	0.1580	0.0293
	Non-Coastal	256	0.1542	0.0295
Lowest *HOUS_00*	Total	402	0.0629	0.0270
[0.0000 - 0.1085]	Metropolitan	13	0.0799	0.0202
	Urban 4 & 5	6	0.0861	0.0170
	Urban 6 & 7	223	0.0667	0.0251
	Rural 8 & 9	160	0.0554	0.0282
	Coastal	87	0.0601	0.0291
	Non-Coastal	315	0.0637	0.0263

From a total of 930 counties, 7.53% (2.15% - highest *HOUS_00* and 5.38% - higher *HOUS_00*) are in the high *HOUS_00* class with a range of 0.3739 to 0.9910, 15.38% belong to the medium *HOUS_00* class with a range of 0.2143 to 0.37.38, and 77.10% (33.87% - lower *HOUS_00* and 43.23% - lowest *HOUS_00*) fit in the low *HOUS_00* class with a range of 0.000 to 0.2142. Housing in the southeast region is a very critical issue. The characteristics of the *HOUS_00* geographic distribution counties in the metropolitan areas have high *HOUS_00* - especially for the counties with large cities. Almost all of the rural and urban counties have low *HOUS_00*. The spatial trend of *HOUS_00* follows rural urban continuum and large cities. (Figure 4.41)

As shown in Table 4.18, on average, in the high *HOUS_00* class, the following are included: 25.60% of the metropolitan counties, 9.68 % of the urban counties with a population more than 20,000, 0.00% of the urban counties with a population between 2,500 and 19.999, and 0.00% of the completely rural counties or the urban counties with a population less than 2,500. On average, in the medium *HOUS_00* class, the following are included: 34.00% of the metropolitan counties, 29.03% of the urban counties with a population more than 20,000, 8.03% of the urban counties with a population between 2,500 and 19.999, and 3.17% of the completely rural counties or the urban counties with a population less than 2,500. On average, in the low *HOUS_00* class, the following are included: 40.40% of the metropolitan counties, 61.29% of the urban counties with a population more than 20,000, 91.69% of the urban counties with a population between 2,500 and 19.999, and 96.83% of the completely rural counties or the urban counties with a population less than 2,500. *HOUS_00* in the coastal counties is higher than *HOUS_00* in the non-coastal counties in all high, medium, and low *HOUS_00* classes; an exception

is in the lowest *HOUS_00* class. *HOUS_00* in the coastal counties is higher than the Southeast region average and non-coastal county's average. The high *HOUS_00* class includes 9.71% of the coastal counties (3.40% - highest *HOUS_00*, 6.31% - higher *HOUS_00*) and 6.91% of the non-coastal counties (1.80% - highest *HOUS_00*, 5.11% - higher *HOUS_00*). The low *HOUS_00* class includes 70.87% of the coastal counties (42.23% - lowest *HOUS_00*, 28.64% - lower *HOUS_00*) and 78.87% of the non-coastal counties (43.51% - lowest *HOUS_00*, 35.36% - lower *HOUS_00*). Since the majority of coastal counties are metropolitan counties and urban 4 & 5 counties, this would suggest higher housing dimension index. One could argue that hurricanes would causes a lower housing dimension index, but it does not. Counties that are directly struck by hurricanes do have low housing indices for this time period, but the housing dimension index is a function of recovery. Future studies could examine the effect.

4.4 Analysis for All Exogenous Variables

Every exogenous variable used in this analysis is classified into four groups:

1. Demographic characteristics (*NATINC* - the ratio of number of births to the number of deaths, *MEDAGE* - median age, and *RACE* - the ratio of percentage of black and other population to the percentage of white population)
2. 1990 social development level characteristics (*ECON_90* - 1990 economic opportunity dimension index, *EDUC_90* - 1990 education educational dimension index, and *HOUS_90* – 1990 housing dimension index)
3. Urban transition characteristics (*LNGRAV*-gravity into the large cities, *RUC*-dummy variables for rural and urban continuum code)

4. Coastal characteristics (*COAST*- dummy variables for coastal and non-coastal counties).

The average of every exogenous variable is provided in Table 4.19.

Table 4.19 The Average of All Exogenous Variables of the Model, by RUC and Coastal Characteristics

RUC/Coastal /States	No. of Counties	Demographic Characteristics			1990 Social Development Level			Urban Transition
		NATINC	*MEDAGE*	*RACE*	*ECON_90*	*EDUC_90*	*HOUS_90*	*LNGRAV*
Southeast	930	1.3004	34.6846	0.4331	0.5510	0.3819	0.1592	12.1649
Metro	250	1.5896	34.2058	0.3207	0.7143	0.4762	0.3037	14.0302
Urban 4 & 5	62	1.4310	33.8043	0.4602	0.6100	0.4430	0.2265	12.8234
Urban 6 & 7	397	1.2308	34.7272	0.4630	0.4968	0.3504	0.1064	11.6953
Rural	221	1.1134	35.3969	0.4991	0.4469	0.3149	0.0718	10.7138
Coastal	206	1.3847	34.4088	0.5429	0.5649	0.4056	0.1833	12.6294
Non-Coastal	724	1.2774	34.7631	0.4019	0.5470	0.3752	0.1523	12.0328
Alabama	67	1.3037	34.2356	0.6991	0.5438	0.3344	0.1340	12.7242
Arkansas	75	1.1285	35.9407	0.2907	0.5668	0.3825	0.1874	11.3200
Florida	67	1.1491	37.3342	0.3536	0.5736	0.4237	0.1704	13.5212
Georgia	159	1.5386	33.4112	0.5893	0.4927	0.3851	0.1265	12.0967
Kentucky	120	1.2551	34.8720	0.0523	0.5531	0.3980	0.1195	11.7397
Louisiana	64	1.5025	32.4483	0.6084	0.6170	0.3934	0.2042	12.5216
Mississippi	82	1.4253	32.2131	0.9607	0.5843	0.4035	0.1952	11.8875
N. Carolina	100	1.2899	35.7273	0.4371	0.5917	0.3366	0.1824	12.5999
S. Carolina	46	1.4162	33.7815	0.7793	0.5725	0.3987	0.2158	12.3439
Tennessee	95	1.1971	35.8314	0.1221	0.5001	0.3316	0.0983	12.5462
W. Virginia	55	0.9764	36.7297	0.0299	0.5437	0.4535	0.2284	10.5077

4.4.1 Demographic Characteristics

4.4.1.1 Natural Increase for 1995

As shown in Table 4.19, the southeast region's natural increase, or the ratio of the number of births to the number of deaths, for 1995 at the county level (*NATINC*) is 1.3004. This means the number of births is 1.3 times greater than the number of deaths. The range of *NATINC* is 0.4668 (Citrus County, FL) to 7.2165 (Chattahoochee County, GA).

The average *NATINC* for counties in metropolitan areas and urban counties with an urban population greater than 20,000 is higher than the Southeast average. *NATINC* for urban counties with an urban population below 20,000 and completely rural counties are smaller than the Southeast average. *NATINC* in the coastal counties are higher than the average *NATINC* in the non-coastal counties and the southeast region.

The states of Georgia (highest), Louisiana, Mississippi, South Carolina, and Alabama have above the Southeast average *NATINC;* the states of West Virginia (lowest), Arkansas, Florida, Tennessee, Kentucky, and North Carolina have below the Southeast average *NATINC*. Figure 4.43(A) illustrates *NATINC*. *NATINC* is classified into 5 classes using the natural break classification schemes.

From a total of 930 counties, 9.57% (2.15% - highest *NATINC* and 7.42% higher *NATINC*) are in the high *NATINC* class with a range of 1.8907 to 7.2165. Out of 930 counties, 24.62% belong to the medium *NATINC* class with a range of 1.4205 to 1.8906, while 65.8% (42.04% - lower *NATINC* and 23.76% - lowest *NATINC*) fit in the low *NATINC* class with a range of 0.4668 to 1.0707 (Figure 4.43(A)).

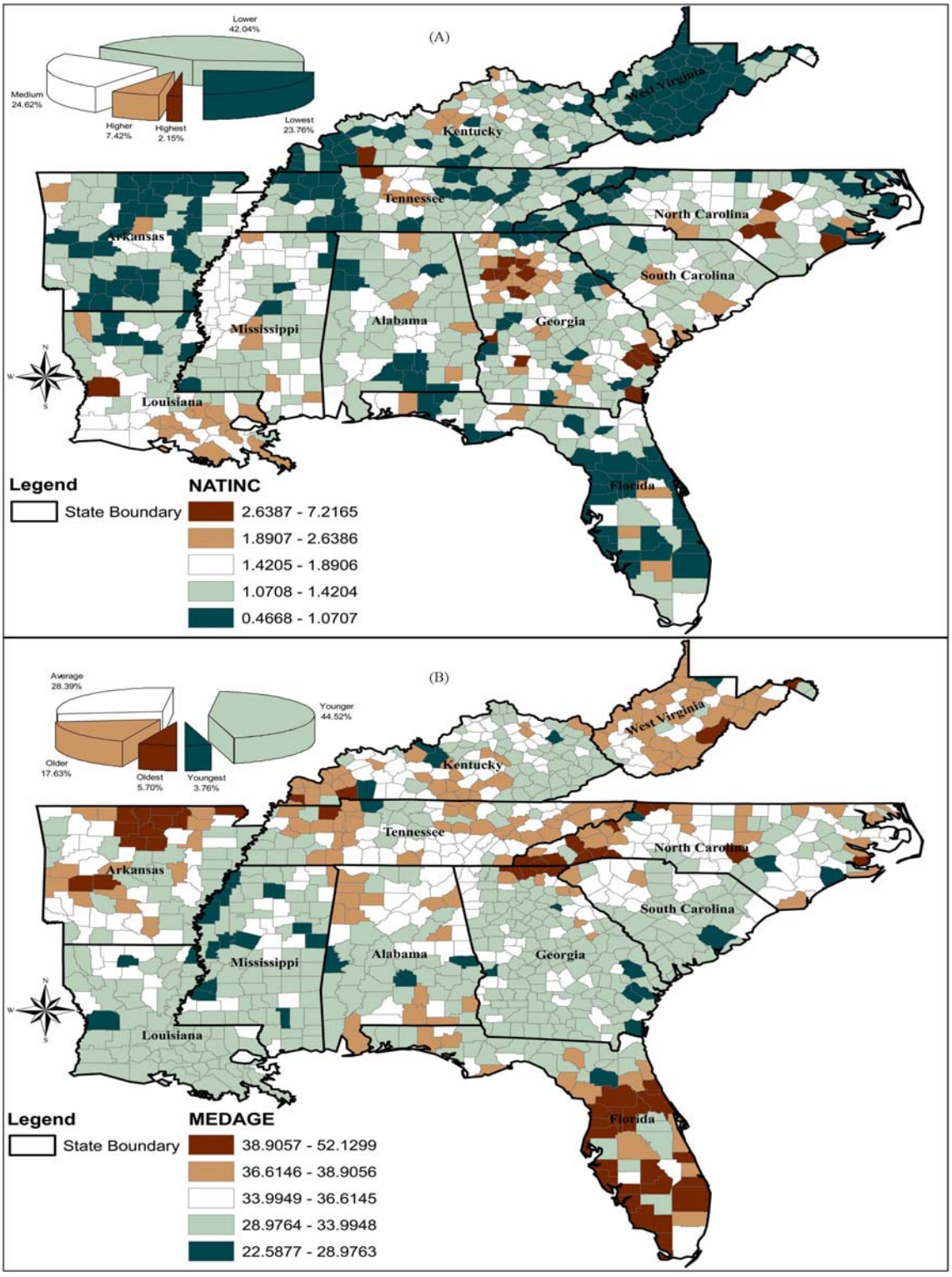


Figure 4.43 (A) Natural Increase (Ratio of the Number of Births to the Number of Deaths) and (B) Median Age of the Southeast Region, 1995

4.4.1.2 Median Age for 1995

As shown in Table 4.19, the Southeast regional average median age for 1995 at the county level (*MEDAGE*) is 34.6846 within a range of 22.5877 (Chattahoochee County, GA) to 52.1299 (Charlotte County, FL).

Figure 4.43(B) illustrates the *MEDAGE*. The *MEDAGE* is classified into 5 classes using the natural break classification schemes. From a total of 930 counties, 23.33% (5.70% - oldest *MEDAGE* and 17.63% - older *MEDAGE*) are in the high (old) *MEDAGE* class within a range of 36.6146 to 52.1299, 28.39% belong to the medium *MEDAGE* class within a range of 33.9949 to 36.6145, and 48.28% (44.52% - younger *MEDAGE* and 3.76% - youngest *MEDAGE*) fit in the low (young) *MEDAGE* class within a range of 22.5877 to 28.9763. (Figure 4.43(B))

The average *MEDAGE* urban counties with an urban population below 20,000 and completely rural counties are higher than the Southeast average; *MEDAGE* for metropolitan areas and urban counties with an urban population greater than 20,000 are smaller than the Southeast average. *MEDAGE* for the non-coastal counties is slightly higher than average *MEDAGE* in the coastal counties and the southeast region.

Characteristics of *NATINC* and *MEDAGE* geographic distributions are related to each other. Counties that are located in cold spots (decreasing number of births and increasing number of deaths) in the *NATINC* distribution have hot spots (increasing median age or increase in the number of elderly people) in the *MEDAGE* distribution. The states of Florida (oldest), West Virginia, Arkansas, Tennessee, North Carolina, and Kentucky have above the Southeast average *MEDAGE;* the states of Mississippi (youngest), Louisiana, Georgia, South Carolina, and Alabama have below the Southeast

average *MEDAGE*. Areas of Florida, West Virginia, northern and southwestern Arkansas, western North Carolina, southwestern Kentucky, western and eastern Tennessee, and northern Alabama have high median age and a low natural increase. These areas have many retirement communities based on information obtained from the continuing care retirement communities data NAICS Code: 623311, US Census Bureau. Louisiana, Mississippi, Georgia, South Carolina, eastern Kentucky, and central Alabama have low median age and a relatively high or medium natural increase. This is illustrated in Figure 4.13

4.4.1.3 Race

As shown in Table 4.19, the southeast region's average racial distribution, the ratio of number of nonwhite population to the number of white population, for 1995 at the county level (*RACE*) is 0.4331 within a range of 0.0024 (Wirt County, WV) to 6.5555 (Jefferson County, MS). The average *RACE* equaled 0.4331, which meant that on average, from the total population of the southeast region, approximately 30.22% of the people are black and other race population; 69.78% of the people are white race population at the county level.

Figure 4.44 (A) illustrates the *RACE* and (B) shows the racial decomposition at the state level. In Figure 4.44(A), the *RACE* was classified into 5 classes using the natural break classification schemes.

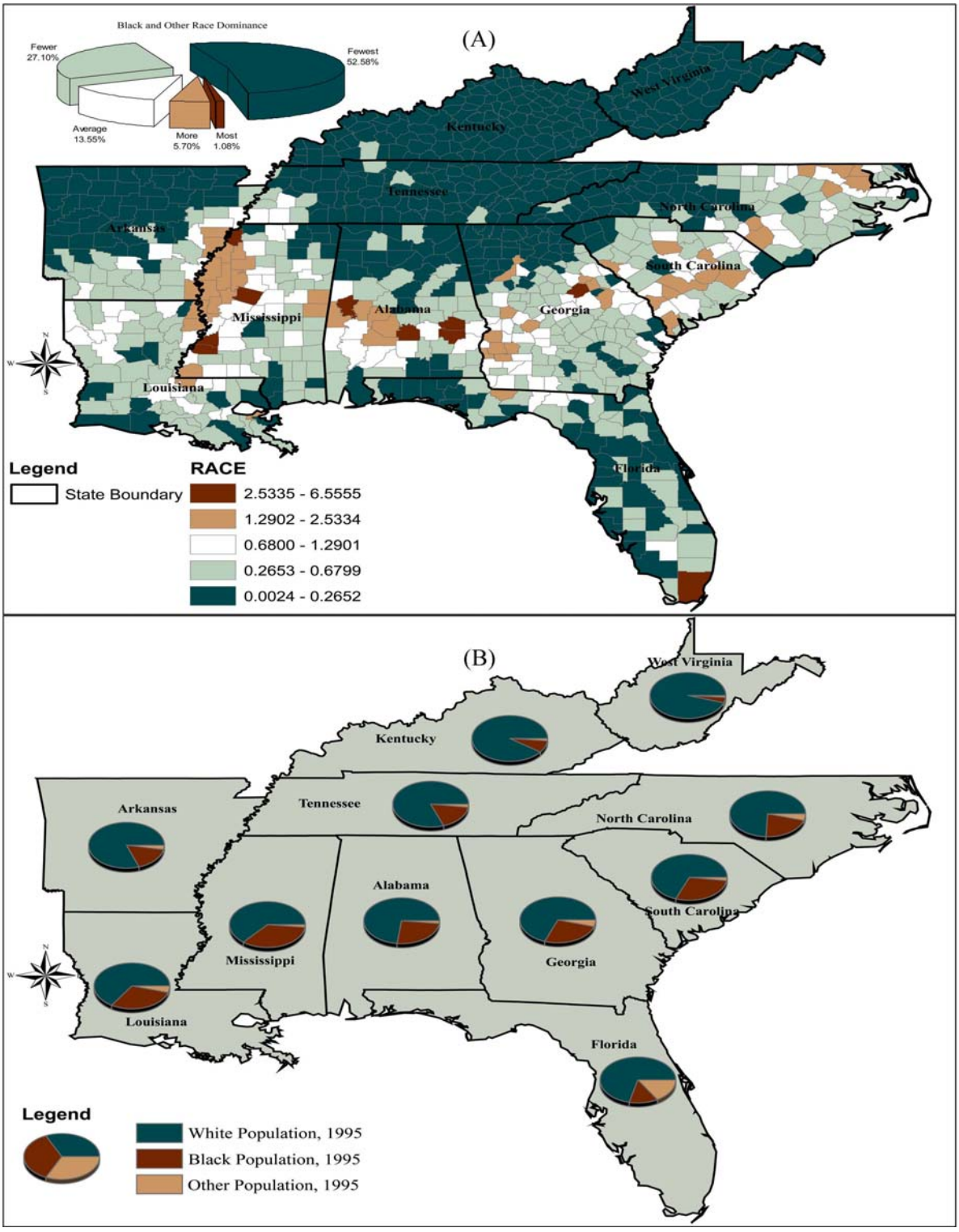


Figure 4.44 (A) Race (Ratio of the Percentage of Nonwhites to Percentage of Whites) at the County level and (B) Racial Decomposition at the State Level for the Southeast Region, 1995

From a total of 930 counties, 6.78% (1.08% - nonwhites are the most populated and 5.70% - nonwhites are more populated) are in the high *RACE* class with a range of 1.2902 to 6.5555. From a total of 930 counties, 13.55% belong to the medium *RACE* class with a range of 0.6800 to 1.2901, while 79.68% (27.10% - whites are more populated (nonwhites are fewer) and 52.58% - whites are the most populated (nonwhites are the fewest)) fit in the low *RACE* class with a range of 0.0024 to 0.6799. (Figure 4.44(A))**

The average *RACE* for urban and rural counties is higher than the Southeast average; *RACE* for counties in metropolitan areas is smaller than the Southeast average. *RACE* in the coastal counties is higher than the average *RACE* in the non-coastal counties and the southeast region, which meant that coastal counties (36.09% - nonwhites, 63.91% - whites) are more diversified than non-coastal counties (28.67% - blacks and others, 71.33% - whites).

For the state of Mississippi, on average at the county level, *RACE* = 0.9607, which means that 48.99% are nonwhites, and 51.01% are whites (most diversified population at the county level); South Carolina, Alabama, Louisiana, Georgia, and North Carolina have above the Southeast average *RACE*; and the states of West Virginia, Kentucky, Tennessee, Arkansas, and Florida have below the Southeast average *RACE* at the county level. At the state level, when compared to the other states, West Virginia, Kentucky, Tennessee, and Arkansas have the largest share of the white population, while Mississippi, South Carolina, and Louisiana have the largest share of the black population; Florida, North Carolina, Georgia, and Louisiana have the largest share of the other population. (Figure 4.44(B))

There is also a relationship between the characteristics of *NATINC*, *MEDAGE*, and *RACE* geographic distribution. The counties that are located in the cold spots (decreasing number of blacks/others and increasing in the number of whites) in *RACE* distribution have hot spots (increasing median age or increase in the number of elderly people) in the *MEDAGE* distribution and cold spots (decreasing number of births or increasing number of deaths) in the *NATINC* distribution. For instance, areas of the Delta, Piedmont region, and central Alabama had high *RACE*, low *MEDAGE*, and medium *NATINC*. The relationship between demographic characteristics and endogenous variables are included in the correlation analysis in detail.

4.4.2 1990 Social Development Level Characteristics

The level of the 1990 social development is measured by the economic opportunity dimension index (*ECON_90*), educational dimension index (*EDUC_90*), and housing dimension index (*HOUS_90*).

4.4.2.1 1990 Economic Opportunity Dimension Index

Shown in Table 4.19, the Southeast region's average economic opportunity dimension index at the county level (*ECON_90*) is 0.5410 with a range of 0 (East Carroll County, Louisiana) to 1(Fayette County, Georgia, Shelby County, Alabama, Williamson County, Tennessee). Figure 4.45 illustrates the economic opportunity dimension index (*ECON_90*). *ECON_90* is classified into 5 classes using the natural break classification schemes. The states of Louisiana (highest), North Carolina, Mississippi, Florida, South Carolina, Arkansas, and Kentucky have above the Southeast average *ECON_90;* Georgia

(lowest), Tennessee, West Virginia, and Alabama have below the Southeast average *ECON_90*.

Average *ECON_90* for counties in the metropolitan areas and urban counties with an urban population greater than 20,000 is higher than the Southeast average; *ECON_90* for urban counties with an urban population below 20,000 and completely rural counties are smaller than the Southeast average. Counties in metropolitan areas with neighboring urban counties have high *ECON_90* - especially for the counties that are in close proximity to the interstate highways. Most of the rural and southern urban counties have a low *ECON_90*. Low *ECON_90* counties tend to be located further from interstate highways. *ECON_90* in the coastal counties is higher than for the southeast region or the non-coastal counties' average.

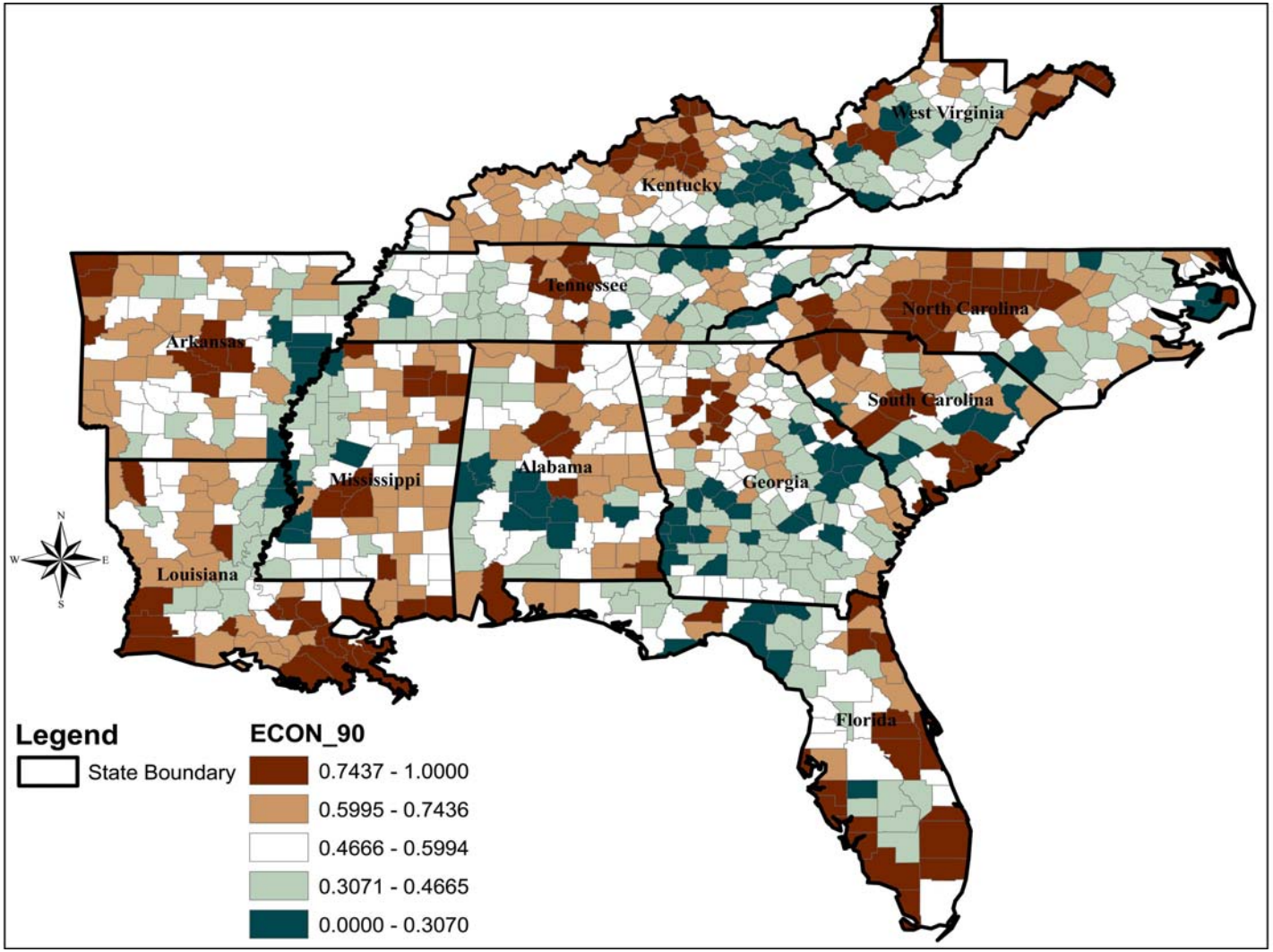


Figure 4.45 Economic Opportunity Dimension Index for the Southeast Region, 1990

4.4.2.2 1990 Education Dimension Index

Shown in Table 4.19, the southeast region's average education dimension index at the county (*EDUC_90*) level is 0.3819 within a range of 0.0540 (Winston County, Alabama) to 0.9178 (Williamson County, Tennessee). Figure 4.46 illustrates the 1990 education dimension index (*EDUC_90*). The *EDUC_90* is classified into 5 classes using the natural break classification schemes.

The average *EDUC_90* for counties in metropolitan areas and urban counties with an urban population greater than 20,000 is higher than the Southeast average; *EDUC_90* for urban counties with an urban population below 20,000 and completely rural counties is smaller than the Southeast average. Metropolitan areas and their neighbor urban counties have high *EDUC_90* - especially for the counties that are in close proximity to the interstate highways. Most of the rural and southern urban counties have a low *EDUC_90*. Low *EDUC_90* counties tend to be located further from interstate highways. Large cities and universities with a significant student enrollment have higher *EDUC_90*. As shown in Table 4.19, *EDUC_90* in the coastal counties is higher than the southeast region average and non-coastal counties' average.

The states of West Virginia (highest), Florida, Mississippi, South Carolina, Kentucky, Louisiana, Georgia, and Arkansas have above the Southeast average *EDUC_90;* the states of Tennessee (lowest), Alabama, and North Carolina have below the Southeast average *EDUC_90*.

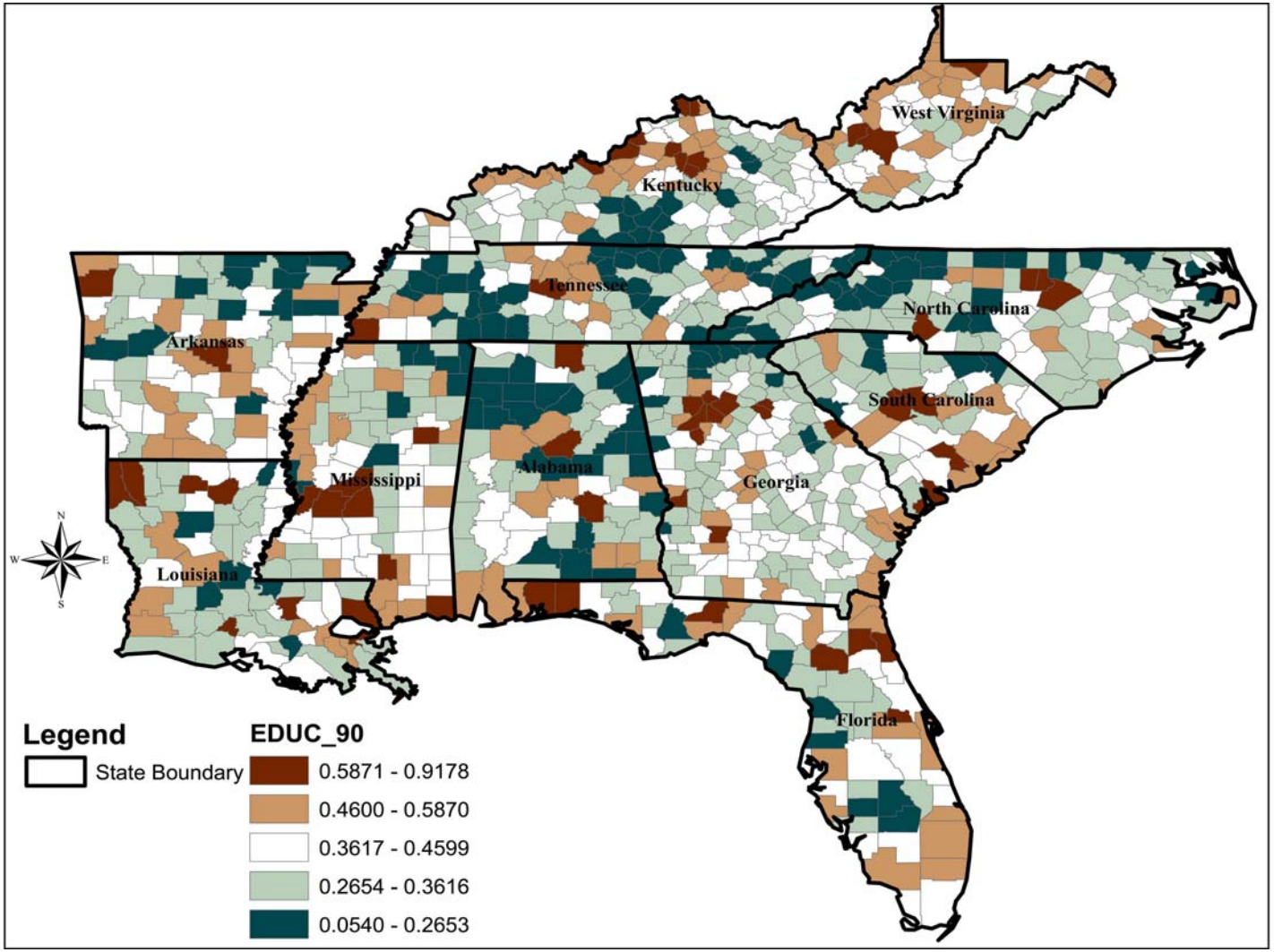


Figure 4.46 Education Dimension Index for the Southeast Region, 1990

4.4.2.3 1990 Housing Dimension Index

As shown in Table 4.19, the southeast region's average housing dimension index at the county level (*HOUS_90*) is 0.1592 with a range of 0.000 (Taliaferro County, GA, Tyrrell County, NC) to 1 (Pulaski County, AR). Figure 4.47 illustrates the housing dimension index (*HOUS_90*). *HOUS_90* is classified into 5 classes using the natural break classification schemes.

Average *HOUS_90* for counties in metropolitan areas and urban counties with an urban population greater than 20,000 is higher than the Southeast average; *HOUS_90* for urban counties with an urban population below 20,000 and completely rural counties is smaller than the Southeast average. Counties in the metropolitan areas have high *HOUS_90* - especially for those counties with large cities. Rural and urban counties have low *HOUS_90*. (Figure 4.47) The *HOUS_90* in the coastal counties is higher than the southeast region average and non-coastal counties' average.

The states of West Virginia (highest), South Carolina, Louisiana, Mississippi, Arkansas, North Carolina, and Florida have above the Southeast average *HOUS_90;* the states of Tennessee (lowest), Kentucky, Georgia, and Alabama have below the Southeast average *HOUS_90*.

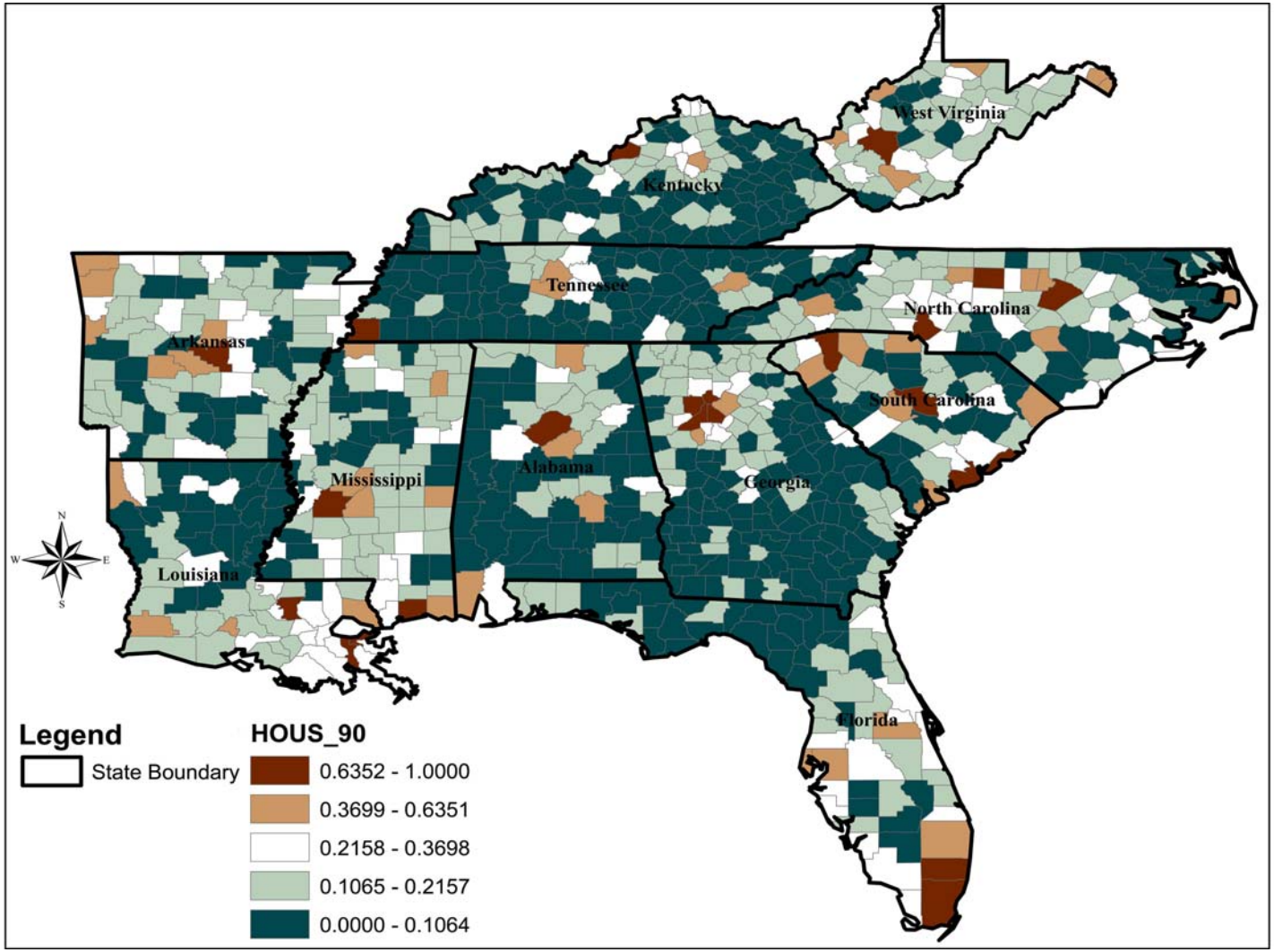


Figure 4.47 Housing Dimension Index for the Southeast Region, 1990

4.4.3 Urban Transition Characteristics

The gravity variable used here is the natural log of the distance from the center of the county to the nearest city with a population of greater than 100,000. As shown in Table 4.19, the southeast region's average for the log gravity variable (*LNGRAV*) is 12.1646 within a range of 8.6286 (Tyrrell County, NC) to 24.4825 (Davidson County, TN). If a county has a high *LNGRAV*, this means that the county's location is closer to the large city and has a stronger influence both on and from the large city; if a county has a low *LNGRAV*, this means that the county is located far from any large cities and has weak influence from the large cities. Average *LNGRAV* for counties in metropolitan areas and urban counties with an urban population greater than of 20,000 is higher than the Southeast average; *LNGRAV* for urban counties with an urban population below 20,000 and completely rural counties are smaller than the Southeast average. Figure 4.48 illustrates the logarithm of the gravity into the large cities with a population greater than 100,000 from each county (*LNGRAV*). The *LNGRAV* is classified into 5 classes using the natural break classification schemes.

Metropolitan areas have high *LNGRAV* - especially for these counties with large cities. A majority of the rural and urban counties have low *LNGRAV*, as shown in Figure 4.48. The *LNGRAV* in the coastal counties is higher than the southeast region average and non-coastal county's average.

The states of Florida (highest), Alabama, North Carolina, Tennessee, Louisiana, and South Carolina have above the Southeast average *LNGRAV;* the states of West Virginia (lowest), Arkansas, Kentucky, Mississippi, and Georgia have below the Southeast average *LNGRAV*.

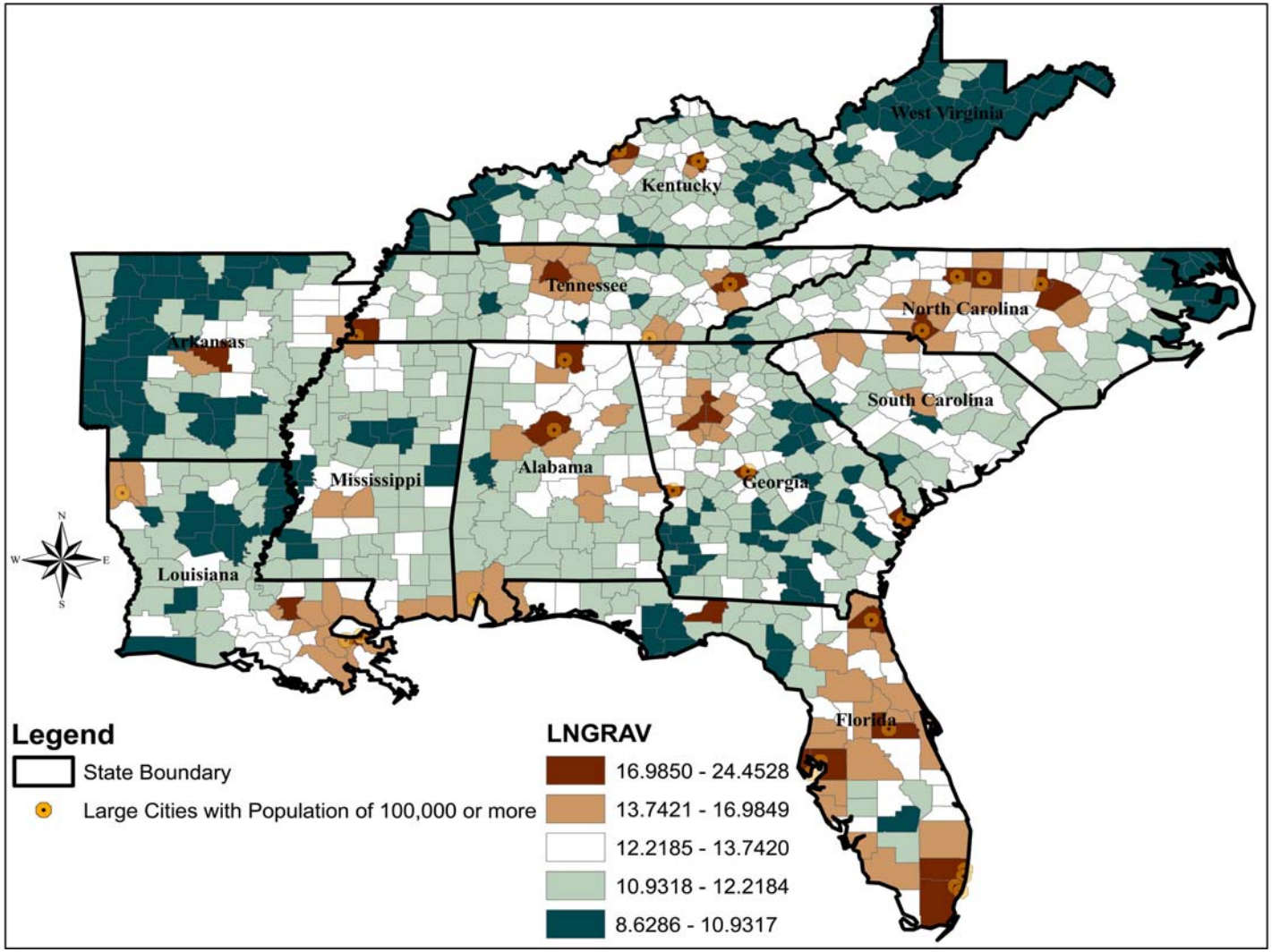


Figure 4.48 The Average Gravity into the Large Cities of the Southeast Region, 1995

4.5 Descriptive Statistics Analysis for All Variables

The overview of the dataset has been provided with significant detail. The next step is to provide an overview on how to employ the dataset into further analysis. The basic features of all variables, which are described by descriptive statistics, are reported in Table 4.20.

Table 4.20 Summary Statistics for All Variables

Variables	N	Minimum	Maximum	Mean	Std. Dev.	Skewness	Kurtosis
PINCGRO	930	0.9874	1.0932	1.0213	0.0116	0.3625	2.2004
EMPGRO	930	0.9317	1.1250	1.0153	0.0228	0.4780	1.5095
ESTGRO	930	0.9194	1.1870	1.0121	0.0220	1.3739	7.0418
SESTGRO	930	0.9059	1.1864	1.0107	0.0225	1.2010	6.2936
MESTGRO	930	0.8027	1.2457	1.0250	0.0458	0.5398	4.6919
LESTGRO	930	0.6667	1.3408	1.0098	0.0742	0.0719	3.3006
DENGRO	930	0.9777	1.1067	1.0099	0.0131	1.5275	5.2602
IMRR	930	9.6469	118.9162	38.0782	14.7738	1.1362	1.9148
OMRR	930	17.7259	188.1766	32.2891	9.9140	5.2863	67.9006
EDUC_00	930	0.0076	0.9574	0.3787	0.1362	0.7013	0.5747
ECON_00	930	0.0000	1.0000	0.5418	0.1844	-0.1399	-0.1079
HOUS_00	930	0.0000	0.9910	0.1657	0.1492	2.3717	7.1662
MEDAGE	930	22.5877	52.1299	34.6846	3.2889	0.6565	3.4650
NATINC	930	0.4668	7.2165	1.3696	0.5173	3.7272	29.2322
RACE	930	0.0024	6.5555	0.4331	0.6118	4.0943	28.0035
ECON_90	930	0.0000	1.0000	0.5510	0.1806	-0.1476	-0.1296
EDUC_90	930	0.0540	0.9178	0.3819	0.1225	0.6527	0.7090
HOUS_90	930	0.0000	1.0000	0.1592	0.1499	2.4560	7.7916
LNGRAV	930	8.6286	24.4528	12.1649	1.8583	2.2396	8.3087

Shown in Table 4.20, the values for skewness and kurtosis for *OMRR, NATINC,* and *RACE* are far from the values that a loud support a normal distribution; *ESTGRO, SESTGRO, DENGRO, HOUS_00, HOUS_90*, and *LNGRAV* are also kurtosic. Therefore, outliers are defined, as well as the normal transformation, which need to be applied for some variables.

Chattahoochee County in Georgia, with an out migration rate of 188 and an immigration rate of 118 (per 1000 people from 1995 to 2000), is definitely the outlier for the *OMRR* and *IMRR*. The population for the county of Issaquena in Mississippi is only 1,598, which is the lowest in the Southeast. It, too, is an outlier. Fulton County in Georgia (0.99 is the 2000 housing dimension index) and Pulaski County in Arkansas (*HOUS_00* = 0.95) are outliers for *HOUS_00*. Dawson County in Georgia (1.19 - average annual rate of change in number of establishment from 1995 to 2000) is the outlier for *ESTGRO*. Davidson County in Tennessee (24.45 - the natural logarithm of the gravity into the large cities with a population of 100,000 or more) is the outlier of the *LNGRAV*. The natural logarithm transformation has been applied to *DENGRO, IMRR, OMRR, NATINC*, and *RACE* variables.

Table 4.21 reports the descriptive statistics for all variables (excluding the outliers) after the transformation. As shown in Table 4.21, there are no serious non-normality problems for any of the variables. *HOUS_00*, *HOUS_90*, and *LNGRAV* variables are slightly skewed and positively kurtosic. However, the problems in these three variables are not vital issues for further analysis. For structural equation modeling, outliers are not a problem since the covariance matrix is employed. The statistical cluster

analysis uses 924 counties instead of the entire 930 counties in the southeastern United States.

Table 4.21 Summary Statistics for All Variables after Transformation

Variables	N	Minimum	Maximum	Mean	Std. Dev.	Skewness	Kurtosis
PINCGRO	924	0.9874	1.0932	1.0213	0.0116	0.3563	2.2243
EMPGRO	924	0.9317	1.1250	1.0152	0.0228	0.4835	1.5208
ESTGRO	924	0.9194	1.1287	1.0119	0.0213	0.9569	3.6345
SESTGRO	924	0.9059	1.1223	1.0106	0.0218	0.7911	3.0739
MESTGRO	924	0.8027	1.2457	1.0249	0.0457	0.5117	4.7018
LESTGRO	924	0.6667	1.3408	1.0094	0.0737	0.0091	3.1692
LNDENGRO	924	-0.0226	0.1014	0.0098	0.0128	1.3972	4.5543
LN_IMMR	924	2.2666	4.7109	3.5661	0.3696	0.0414	-0.1358
LNOMRR	924	2.8750	4.4849	3.4379	0.2359	0.6673	1.0438
EDUC_00	924	0.0076	0.9574	0.3774	0.1352	0.6937	0.5744
ECON_00	924	0.0000	1.0000	0.5415	0.1841	-0.1367	-0.0927
HOUS_00	924	0.0000	0.8979	0.1636	0.1442	2.2864	6.6736
MEDAGE	924	23.5048	52.1299	34.7099	3.2708	0.7057	3.4240
LNNATINC	924	-0.7618	1.8300	0.2588	0.3028	0.5227	1.6978
LNRACE	924	-6.0499	1.8803	-1.7689	1.5773	-0.4398	-0.6558
ECON_90	924	0.0000	1.0000	0.5507	0.1805	-0.1486	-0.1233
EDUC_90	924	0.0540	0.9178	0.3811	0.1215	0.6428	0.7256
HOUS_90	924	0.0000	0.9236	0.1571	0.1449	2.3799	7.4062
LNGRAV	924	8.6286	22.6519	12.1388	1.7841	2.0873	7.3889

Table 4.22, Table 4.23, and Table 4.24 report the summary statistics by urban/rural differences (rural urban continuum code) and coastal/non-coastal differences for the 924 counties in the southeastern United States.

Table 4.22 Summary Statistics for the Economic Growth Variables by Rural/Urban and Coastal/Non-Coastal Differences

RUC/ Coastal	*Statistics*	*PINCGRO*	*EMPGRO*	*ESTGRO*	*SESTGRO*	*MESTGRO*	*LESTGRO*
Total	Max.	1.0932	1.1250	1.1287	1.1223	1.2457	1.3408
(N=924)	Min.	0.9874	0.9317	0.9194	0.9059	0.8027	0.6667
	Mean	1.0213	1.0152	1.0119	1.0106	1.0249	1.0094
	Std. Dev.	0.0116	0.0228	0.0213	0.0218	0.0457	0.0737
Metro	Max.	1.0558	1.1093	1.1287	1.1223	1.2242	1.3408
(N=246)	Min.	0.9996	0.9864	0.9630	0.9620	0.9221	0.6667
	Mean	1.0248	1.0235	1.0230	1.0208	1.0383	1.0324
	Std. Dev.	0.0095	0.0193	0.0227	0.0228	0.0369	0.0626
Urban 4 & 5	Max.	1.0422	1.0514	1.0477	1.0459	1.0659	1.1220
(N=62)	Min.	0.9936	0.9701	0.9886	0.9848	0.9662	0.9441
	Mean	1.0199	1.0077	1.0100	1.0080	1.0231	1.0184
	Std. Dev.	0.0087	0.0176	0.0099	0.0104	0.0181	0.0371
Urban 6 & 7	Max.	1.0551	1.1025	1.1211	1.1097	1.2345	1.2457
(N=397)	Min.	0.9883	0.9317	0.9590	0.9059	0.8913	0.7000
	Mean	1.0183	1.0096	1.0072	1.0062	1.0176	1.0027
	Std. Dev.	0.0110	0.0213	0.0165	0.0182	0.0375	0.0649
Rural	Max.	1.0932	1.1250	1.0905	1.0864	1.2457	1.3195
(N=219)	Min.	0.9874	0.9423	0.9194	0.9361	0.8027	0.7000
	Mean	1.0231	1.0184	1.0084	1.0078	1.0233	0.9931
	Std. Dev.	0.0138	0.0267	0.0248	0.0251	0.0659	0.0981
Coastal	Max.	1.0551	1.0799	1.1211	1.1097	1.2345	1.2457
(N=206)	Min.	0.9951	0.9575	0.9194	0.9059	0.8706	0.6667
	Mean	1.0218	1.0191	1.0152	1.0137	1.0291	1.0085
	Std. Dev.	0.0104	0.0212	0.0200	0.0205	0.0445	0.0736
Non-Coastal	Max.	1.0932	1.1250	1.1287	1.1223	1.2457	1.3408
(N=719)	Min.	0.9874	0.9317	0.9331	0.9361	0.8027	0.7000
	Mean	1.0211	1.0141	1.0109	1.0097	1.0236	1.0097
	Std. Dev.	0.0119	0.0231	0.0215	0.0220	0.0460	0.0738

Table 4.23 Summary Statistics for the Population Growth and 2000 Social Development Variables by Rural/Urban and Coastal/Non-Coastal Differences

RUC/ Coastal	Statistics	*LNDENGRO*	*LN_IMMR*	*LNOMRR*	*ECON_00*	*EDUC_00*	*HOUS_00*
Total	Max.	0.1014	4.7109	4.4849	0.9574	1.0000	0.8979
(N=924)	Min.	-0.0226	2.2666	2.8750	0.0076	0.0000	0.0000
	Mean	0.0098	3.5661	3.4379	0.3774	0.5415	0.1636
	Std. Dev.	0.0128	0.3696	0.2359	0.1352	0.1841	0.1442
Metro	Max.	0.1014	4.6334	4.3943	1.0000	0.9574	0.8979
(N=246)	Min.	-0.0109	2.4498	3.0667	0.3013	0.1855	0.0414
	Mean	0.0161	3.7428	3.5280	0.7101	0.4943	0.3007
	Std. Dev.	0.0162	0.3622	0.2382	0.1402	0.1421	0.1886
Urban 4 & 5	Max.	0.0308	4.4338	4.4849	0.9492	0.7368	0.5539
(N=62)	Min.	-0.0161	2.7146	2.9555	0.1415	0.1226	0.0670
	Mean	0.0053	3.5498	3.5292	0.5681	0.4414	0.2232
	Std. Dev.	0.0090	0.3961	0.2992	0.1485	0.1178	0.1093
Urban 6 & 7	Max.	0.0507	4.7109	4.2110	0.8361	0.6449	0.3672
(N=397)	Min.	-0.0226	2.2666	2.8897	0.0000	0.0547	0.0002
	Mean	0.0069	3.4606	3.3914	0.4825	0.3331	0.1137
	Std. Dev.	0.0099	0.3268	0.2188	0.1536	0.0973	0.0677
Rural	Max.	0.0640	4.4967	3.9995	0.6068	0.8459	0.2762
(N=219)	Min.	-0.0145	2.5546	2.8750	0.0076	0.0282	0.0000
	Mean	0.0091	3.5634	3.3952	0.3084	0.4517	0.0832
	Std. Dev.	0.0114	0.3705	0.2063	0.0932	0.1604	0.0560
Coastal	Max.	0.0507	4.7109	4.4849	0.9915	0.7677	0.8868
(N=206)	Min.	-0.0161	2.4498	2.9062	0.0954	0.1527	0.0002
	Mean	0.0111	3.6303	3.4807	0.5426	0.4006	0.1834
	Std. Dev.	0.0118	0.4117	0.2624	0.1940	0.1242	0.1680
Non-Coastal	Max.	0.1014	4.6334	4.2838	0.9574	1.0000	0.8979
(N=719)	Min.	-0.0226	2.2666	2.8750	0.0076	0.0000	0.0000
	Mean	0.0094	3.5477	3.4256	0.3708	0.5412	0.1579
	Std. Dev.	0.0130	0.3547	0.2264	0.1375	0.1813	0.1362

Table 4.24 Summary Statistics for the Exogenous Variables by Rural/Urban and Coastal/Non-Coastal Differences

RUC/ Coastal	Statistics	*MEDAGE*	*LNNATINC*	*LNRACE*	*ECON_90*	*EDUC_90*	*HOUS_90*	*LNGRAV*
Total	Max.	52.1299	1.8300	1.8803	1.0000	0.9178	0.9236	22.6519
(N=924)	Min.	23.5048	-0.7618	-6.0499	0.0000	0.0540	0.0000	8.6286
	Mean	34.7099	0.2588	-1.7689	0.5507	0.3811	0.1571	12.1388
	Std. Dev.	3.2708	0.3028	1.5773	0.1805	0.1215	0.1449	1.7841
Metro	Max.	52.1299	1.5182	1.0361	1.0000	0.9178	0.9236	22.6519
(N=246)	Min.	25.2275	-0.6861	-5.1425	0.3462	0.1863	0.0311	9.7712
	Mean	34.2710	0.4559	-1.7315	0.7152	0.4736	0.2982	13.9469
	Std. Dev.	3.5496	0.3401	1.1929	0.1346	0.1363	0.1900	2.2368
Urban 4 & 5	Max.	50.1996	1.8300	0.6281	0.8600	0.6667	0.5191	14.3168
(N=62)	Min.	23.5048	-0.7618	-3.6004	0.2382	0.2205	0.0689	11.1226
	Mean	33.8043	0.3584	-1.2840	0.6100	0.4430	0.2265	12.8234
	Std. Dev.	4.4815	0.3550	1.1129	0.1303	0.1051	0.0980	0.6839
Urban 6 & 7	Max.	51.6742	1.4807	1.8666	0.8525	0.6667	0.3794	13.6012
(N=397)	Min.	25.3424	-0.6146	-5.2724	0.0000	0.0540	0.0041	9.8292
	Mean	34.7272	0.2077	-1.6072	0.4968	0.3504	0.1064	11.6953
	Std. Dev.	2.7809	0.2203	1.5152	0.1451	0.0898	0.0635	0.7397
Rural	Max.	45.7867	1.0875	1.8803	0.8729	0.5439	0.2535	12.4663
(N=219)	Min.	23.6292	-0.4699	-6.0499	0.0306	0.1105	0.0000	8.6286
	Mean	35.4281	0.1018	-2.2411	0.4467	0.3152	0.0712	10.7181
	Std. Dev.	3.2401	0.2420	2.0192	0.1642	0.0841	0.0486	0.7221
Coastal	Max.	52.1299	1.8300	1.0361	0.9244	0.7952	0.9140	21.9333
(N=206)	Min.	23.5048	-0.7618	-2.8219	0.1370	0.1105	0.0000	8.6286
	Mean	34.4088	0.3255	-0.8938	0.5649	0.4056	0.1833	12.6294
	Std. Dev.	4.1654	0.3652	0.7682	0.1765	0.1176	0.1701	2.1093
Non-Coastal	Max.	51.6742	1.4091	1.8803	1.0000	0.9178	0.9236	22.6519
(N=719)	Min.	23.6292	-0.6146	-6.0499	0.0000	0.0540	0.0000	8.9988
	Mean	34.7963	0.2396	-2.0199	0.5466	0.3740	0.1497	11.9981
	Std. Dev.	2.9627	0.2797	1.6586	0.1816	0.1218	0.1360	1.6543

4.6 Correlation Analysis

The correlation matrix for endogenous variables and exogenous variables are reported in Table 4.25 and Table 4.26. In the multivariate analysis, the bivariate correlation coefficients (r_{xy}) should not be too high. The rule of thumb is to assume multicollinearity in multiple regression; this may be a problem that should be further investigated if the bivariate correlation coefficient is greater than 0.8. In this analysis, there is no evidence of such high bivariate correlation coefficients; the highest bivarate correlation belongs to the correlation between social development level of 2000 and 1990, which was the range of 0.74 to 0.78. Because of the high correlation, the structural equation model II-B is estimated excluding social development level for 1990. The correlation matrix in Table 4.25 and 4.26 is based on 930 counties. This matrix is employed in the structural equation modeling analysis in Chapter 5.

Table 4.25 Correlation Matrix for the Endogenous Variables

	PINCGRO	*EMPGRO*	*ESTGRO*	*LNDENGRO*	*LN_IMMR*	*LNOMRR*	*EDUC_00*	*ECON_00*	*HOUS_00*
PINCGRO	1								
EMPGRO	0.2842**	1							
ESTGRO	0.2939**	0.4587**	1						
LNDENGRO	0.2137**	0.6232**	0.6671**	1					
LN_IMMR	0.2716**	0.5427**	0.5117**	0.6855**	1				
LNOMRR	0.0618	0.1027**	0.1155**	0.0493	0.4840**	1			
EDUC_00	0.2451**	0.2293**	0.2748**	0.2303**	0.4046**	0.4730**	1		
ECON_00	0.3525**	0.4083**	0.4615**	0.5158**	0.5094**	0.2254**	0.6083**	1	
HOUS_00	0.1711**	0.1788**	0.2676**	0.2184**	0.2232**	0.2418**	0.6556**	0.6227**	1

** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.05 level (2-tailed

Table 4.26 Correlation Matrix for the Exogenous Variables

	MEDAGE	*LNNATINC*	*LNRACE*	*ECON_90*	*EDUC_90*	*HOUS_90*	*LNGRAV*
PINCGRO	0.1012**	0.0474	-0.1990**	0.2039**	0.1161**	0.1590**	0.1500**
EMPGRO	0.0447	0.2119**	-0.1425**	0.2469**	0.0972**	0.1318**	0.1158**
ESTGRO	-0.0090	0.3192**	-0.1054**	0.3412**	0.1696**	0.2134**	0.2128**
LNDENGRO	0.0697*	0.3408**	-0.1742**	0.3478**	0.0816*	0.1439**	0.2029**
LN_IMMR	0.0372	0.2584**	-0.0519	0.38523**	0.2090**	0.1820**	0.1912**
LNOMRR	-0.2100**	0.2969**	0.1929**	0.2459**	0.4412**	0.2722**	0.1860**
EDUC_00	-0.1669**	0.4002**	0.0162	0.6059**	0.7483**	0.6628**	0.4578**
ECON_00	0.1415**	0.2901**	-0.2382**	0.7849**	0.4279**	0.5870**	0.4474**
HOUS_00	-0.0740**	0.3592**	0.0125	0.6491**	0.6016**	0.7826**	0.6355**
MEDAGE	1						
LNNATINC	-0.7452**	1					
LNRACE	-0.4387**	0.2813**	1				
ECON_90	0.0727*	0.3127**	-0.0873**	1			
EDUC_90	-0.3524**	0.4718**	0.1537**	0.4653**	1		
HOUS_90	-0.0811*	0.3545**	0.0563	0.6390**	0.6281**	1	
LNGRAV	-0.1419**	0.4412**	0.1932**	0.4690**	0.4327**	0.6747**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

4.6.1 Economic Growth Variables

The average annual rate of change in per capita personal income from 1995 to 2000 (*PINCGRO*) has a statistically significant positive relationship with all variables except *LNOMRR*, *LNNATINC,* and *LNRACE*. However, *PINCGRO* does have a statistically significant negative relationship with *LNRACE*.

The average annual rate of change in the number of people employed from 1995 to 2000 (*EMPGRO*) has a statistically significant positive relationship with all variables

except for *MEDAGE* and *LNRACE*. However, *EMPGRO* has a statistically significant negative relationship with *LNRACE*.

The average annual rate of change in the number of establishments from 1995 to 2000 (*ESTGRO*) has a statistically significant positive relationship with all variables except for *MEDAGE* and *LNRACE*. However, *ESTGRO* has a statistically significant negative relationship with *LNRACE*

4.6.2 Demographic Growth Variables

The average annual rate of change in the population density from 1995 to 2000 (*LNDENGRO*) has a statistically significant positive relationship with all variables except for *LNRACE*. *LNDENGRO* has a statistically significant negative relationship with *LNRACE*.

The in-migration rate per 1000 people from 1995 to 2000 (*LNIMRR*) has a statistically significant positive relationship with all variables except for *MEDAGE* and *LNRACE*. *LNIMRR* has a statistically significant negative relationship with *LNRACE*.

The out-migration rate per 1000 people from 1995 to 2000 (*LNOMRR*) has a statistically significant positive relationship with all variables except for *PINCGRO*, *LNDENGRO*, and *MEDAGE*. *LNOMRR* has a statistically significant negative relationship with *MEDAGE*.

4.6.3 2000 Social Development Variables

The economic opportunity dimension index for 2000 (*ECON_00*) has a statistically significant positive relationship with all variables except for *LNRACE*. *ECON_00* has a statistically significant negative relationship with *LNRACE*.

The education dimension index for 2000 (*EDUC_00*) has a statistically significant positive relationship with all variables except for *MEDAGE* and *LNRACE*. *EDUC_00* has a statistically significant negative relationship with *MEDAGE*.

The housing dimension index for 2000 (*HOUS_00*) has a statistically significant positive relationship with all variables except for *MEDAGE* and *LNRACE*. *HOUS_00* has a statistically significant negative relationship with *MEDAGE*.

4.6.4 Exogenous Variables

The median age for 1995 (*MEDAGE*) has a statistically significant negative relationship with all exogenous variables except for *ECON_90*. *MEDAGE* has a statistically significant positive relationship with *ECON_90*.

The natural increase measurement, or ratio of the number of births to the number of deaths (*LNNATINC*), has a statistically significant positive relationship with all exogenous variables except for *MEDAGE*. *LNNATINC* has a statistically significant negative relationship with *MEDAGE.*

The ratio of the number of blacks/others to the number of whites (*LNRACE*) has a statistically significant positive relationship with *LNNATINC*, *EDUC_90*, and *LNGRAV*. *LNRACE* has a statistically significant negative relationship with *MEDAGE* and *ECON_90*.

The economic opportunity dimension index (*ECON_90*) has a statistically significant positive relationship with all exogenous variables except for *LNRACE*. *ECON_90* has a statistically significant negative relationship with *LNRACE.*

The education dimension index for 1990 (*EDUC_90*) has a statistically significant positive relationship with all exogenous variables except for *MEDAGE*. *EDUC_90* has a statistically significant negative relationship with *MEDAGE.*

The housing dimension index for 1990 (*HOUS_90*) has a statistically significant positive relationship with all exogenous variables except for *MEDAGE* and *LNRACE*. *HOUS_90* has a statistically significant negative relationship with *MEDAGE.*

The gravity to the large cities with a population equal to or greater than 100,000 (*LNGRAV*) has a statistically significant positive relationship with all exogenous variables, except *MEDAGE*. *LNGRAV* has a statistically significant negative relationship with *MEDAGE.*

4.7 Summary

The first objective of Chapter IV is to provide general information and an overview about the dataset structure. The investigation covers 11 states of the southeast region (excluding Virginia), which consists of a total of 930 counties. All variables are classified into 5 classes using the natural break classification schemes in ArcMap. The characteristics of the geographic distribution of all variables and their identification toward cluster location (hot and/or cold spots) are also discussed. For the spatial trend of most variables, interstate highways, large cities, rural and urban differences, coastal and non-coastal differences, and universities with a significant enrollment of students play an important primary role. The analysis considers the difference in rural/urban and coastal/non-coastal counties using the 1993 Rural Urban Continuum Code and coastal areas definition of Strategic Environmental Assessments Division of the National Oceanic and Atmospheric Administration.

The second objective is to demonstrate the basic features of the dataset by descriptive statistics analysis or by summary statistics: the mean, standard deviation, skewness, and kurtosis. Based on the summary statistics, the 5 outliers are determined, and the natural logarithm transformation is applied to *DENGRO, IMRR, OMRR, NATINC*, and *RACE*. For further analysis, the 925 counties are considered for statistical cluster analysis. 930 counties are analyzed for structural equation modeling and GIS raster modeling.

The third objective is to evaluate the correlation between the variables. Also, the objective was to know the "strength" or "magnitude" as well as the significance of the correlation. The significance of a correlation coefficient between variables and its

magnitude is significant or appropriate for the multivariate analysis. The correlation/covariance matrix is employed in the structural equation analysis.

CHAPTER V

DATA ANALYSIS RESULTS

Chapter V provides the results from the data analysis. This chapter consists of four main sections. Together these four sections provide a comprehensive approach combining hierarchical cluster analysis, spatial autocorrelation analysis, structural equation modeling (SEM), GIS and spatial modeling. The four sections in this chapter discuss the findings of the hierarchical cluster analysis and spatial autocorrelation analysis, the results of measurement models and structural equation model, GIS raster model results (including the results of the structural equation modeling mapped into the GIS raster model form),and the findings of the spatial lag model.

5.1 Cluster Analysis

Hierarchical Cluster Analysis: The purpose of the hierarchical cluster analysis is to identify a reasonable number of fairly homogenous clusters, to determine the importance of the rural and urban differences and coastal and non-coastal differences into these homogenous clusters, and to determine linkage between the significance of the hierarchical cluster and spatial autocorrelation analysis results. Hierarchical cluster is carried out for 925 counties. Five outliers are excluded from the analysis.

Agglomerative hierarchical cluster analysis with the nearest neighbor method is employed using the SPSS software. The agglomerative hierarchical cluster terminates

with every county being in one cluster. The results of the hierarchical cluster analysis are displayed with a dendrogram. A dendrogram is a visual illustration of the distance at which clusters are combined. The dendrogram is interpreted from left to right. A vertical line illustrates joined clusters. The position of the line on the scale specifies the distance at which clusters are coupled. Observed distances are rescaled to fall into the range of 1 – 25, so the actual distances are not reported. However, the ratio of the rescaled distances within the dendrogram is the same as the ratio of the original distances. The first vertical line corresponds to the minimum rescaled distance. The next vertical line is at the equivalent distance for the merges. In the last two steps, fairly dissimilar clusters are combined. The dendrogram is employed to identify the actual groups of counties that are similar to each other but different from individuals in other groups in terms of the economic growth, population growth, and social development characteristics.

Spatial autocorrelation analysis: This method is employed to investigate the statistical and the spatial structure of economic growth, population growth, and social development variables for the southeast region. Spatial autocorrelation analysis is employed at the state and regional levels. A Moran I index is employed to estimate the degree of spatial autocorrelation at the global level. The Moran I and the spatial cluster map are visualized using a local indicator of spatial autocorrelation (LISA) and LISA spatial cluster maps.

5.1.1 Hierarchical Cluster Analysis for Economic Growth Factor

Results (dendrogram and compressed figure) for the hierarchical cluster analysis for economic growth variables (*PINCGRO*, *EMPGRO*, *ESTGRO*), with consideration of the gravitation into the large cities (*LNGRAV*) for each state, are illustrated in Figure 5.1 through Figure 5.11. The results for the hierarchical cluster analysis for Alabama are explained in detail. All of the other states followed the same general pattern as provided in the following illustration.

Alabama: Figure 5.1 illustrates the dendrogram for the economic growth variables hierarchical cluster analysis of the state of Alabama. From Figure 5.1, there are five counties that have the highest rescaled distance, or the most dissimilar economic growth characteristics, when compared to the other counties in Alabama. Jefferson County (Cluster A) has the highest rescaled distance, which is followed by the counties of Madison (Cluster B), Mobile (Cluster C), Montgomery (Cluster C), and Shelby (Cluster D). These counties are all metropolitan counties that have the strongest influence of the gravitation into large cities and are the most populated counties.

Cluster H and Cluster I are compact clusters that build a larger Sub-Cluster 2-1. Sub-Cluster 2-1 and compact clusters, such as Cluster G, Cluster F, and Cluster E, build a loose Cluster 2. For the Cluster E, 64.29% are metropolitan counties, 21.43% are urban 4 & 5 counties, and 14.29% are urban 6 & 7 counties. Cluster E has means of 1.52% for *PINCRGO*, 1.94% for *EMPGRO*, and 1.45% for *ESTGRO*. Cluster F has three metropolitan counties and two urban 6 & 7 counties with means of 2.06% for *PINCRGO*, 2.38 % for *EMPGRO*, and 0.63 % for *ESTGRO*. Only one rural county constitutes Cluster G, which has a mean of 3.16% for *PINCRGO*, 1.18% for *EMPGRO*, and -0.71%

for *ESTGRO*. For Cluster H, 75.75% are urban 6 & 7 counties, 21.21% are rural counties, and 3.04% are the urban 4 & 5 counties. Cluster H has means of 1.33% for *PINCRGO*, 0.09 % for *EMPGRO*, and -0.01% for *ESTGRO*. Cluster I has the smallest rescaled distance. Cluster I consists of metropolitan (four counties) and urban counties (two counties – urban 4 & 5, three counties – urban 6 & 7) that do not have a strong economic growth characteristic with means of 1.26% for *PINCGRO*, 0.86% for *EMPGRO*, and 0.65% for *ESTGRO*.

Summary: Based on the results of the hierarchical cluster analysis for the economic growth variables, the following conclusions are made.

1) The clusters that have the highest rescaled distances, or the most dissimilar economic growth characteristics, when compared to the rest of the counties, are the fastest growing counties in the MSA. They have strong economic growth characteristics.
2) The clusters that have high-rescaled distances were counties in urban areas, especially in urban 4 & 5 areas that are adjacent to MSAs; or, urban 4 & 5 counties between MSAs.
3) The clusters that have the lowest rescaled distances are counties that are located in rural areas, or counties located in urban 6 & 7. They are more likely to have lower economic growth characteristics/rate.

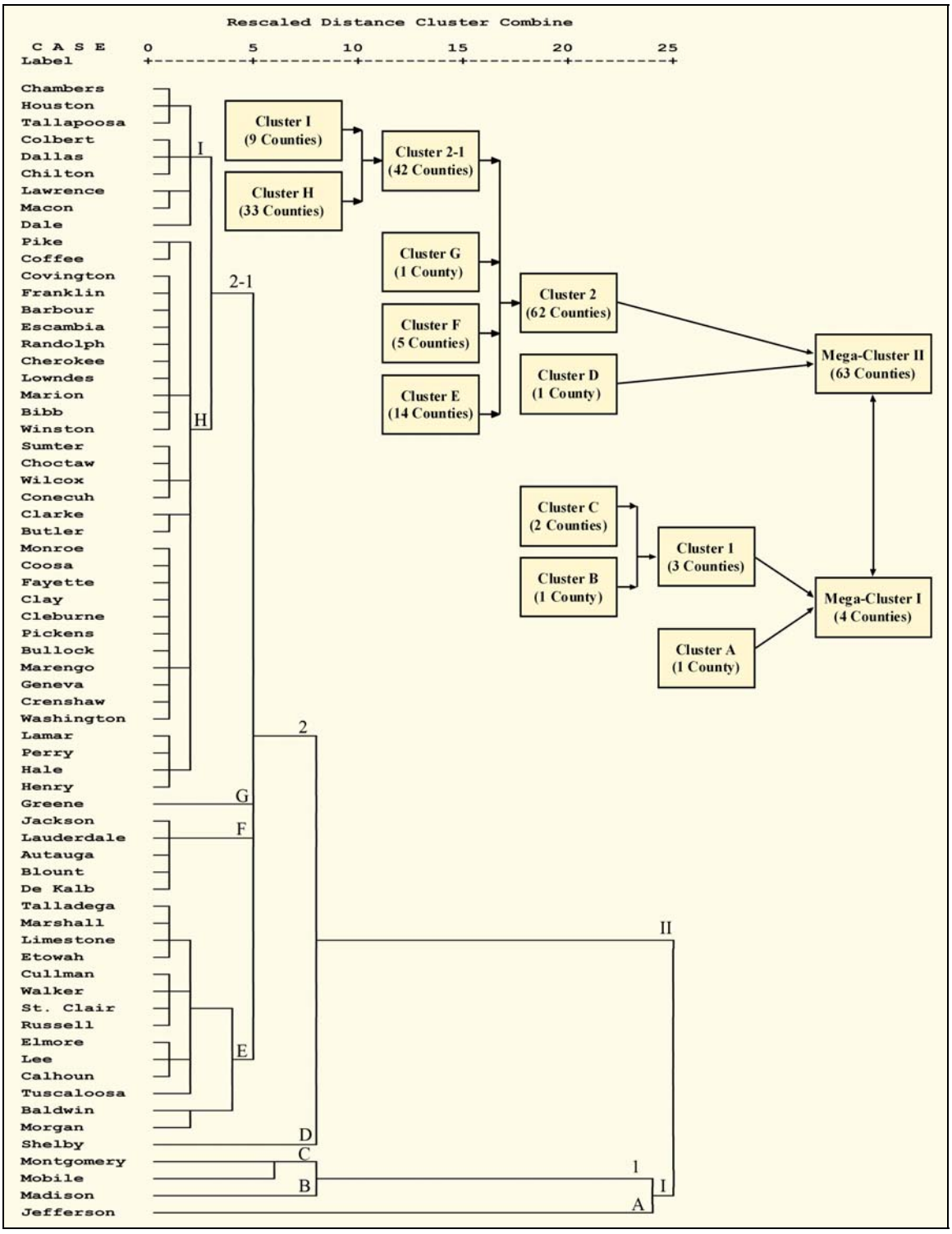


Figure 5.1 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Alabama, 1995 – 2000

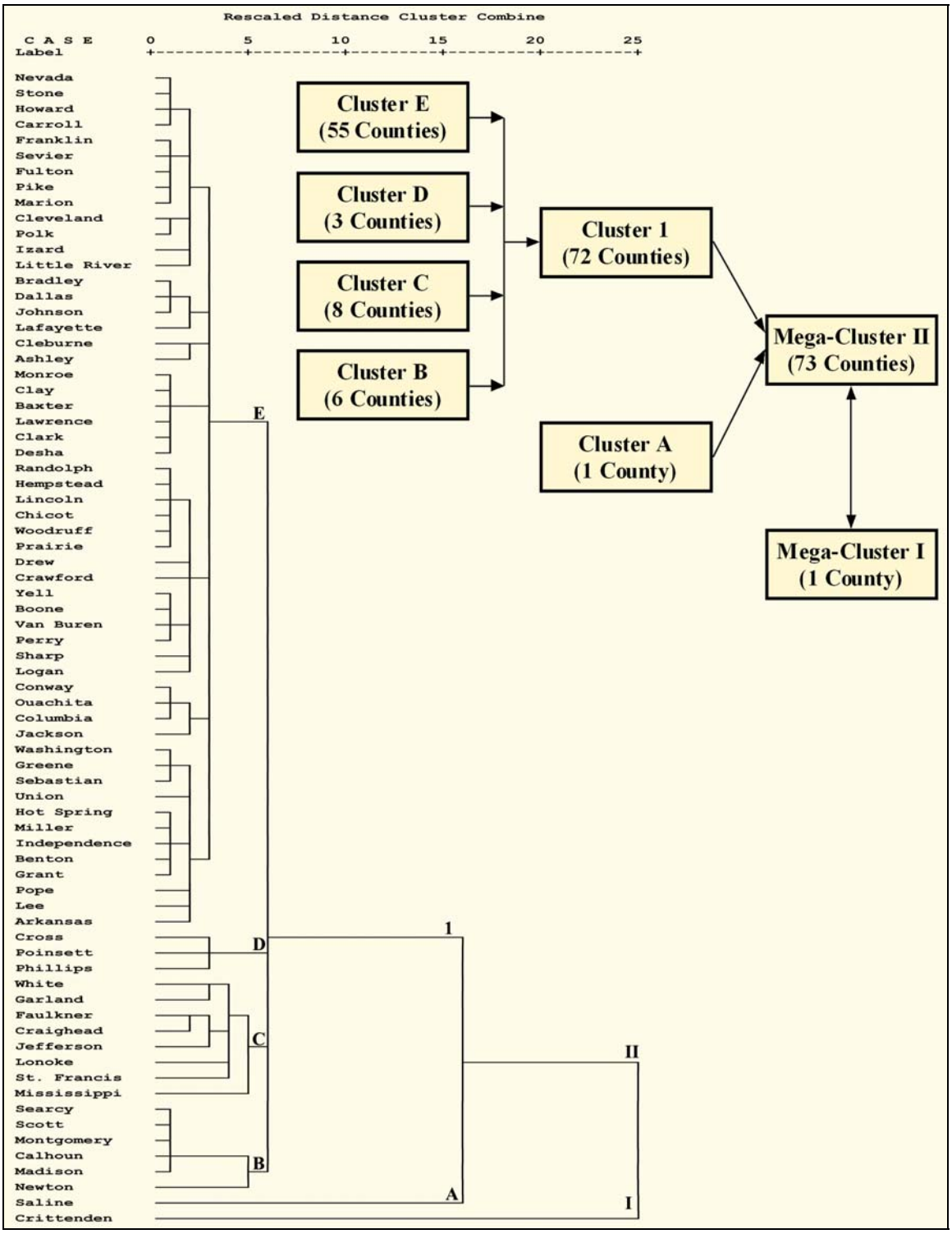


Figure 5.2 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Arkansas, 1995 – 2000

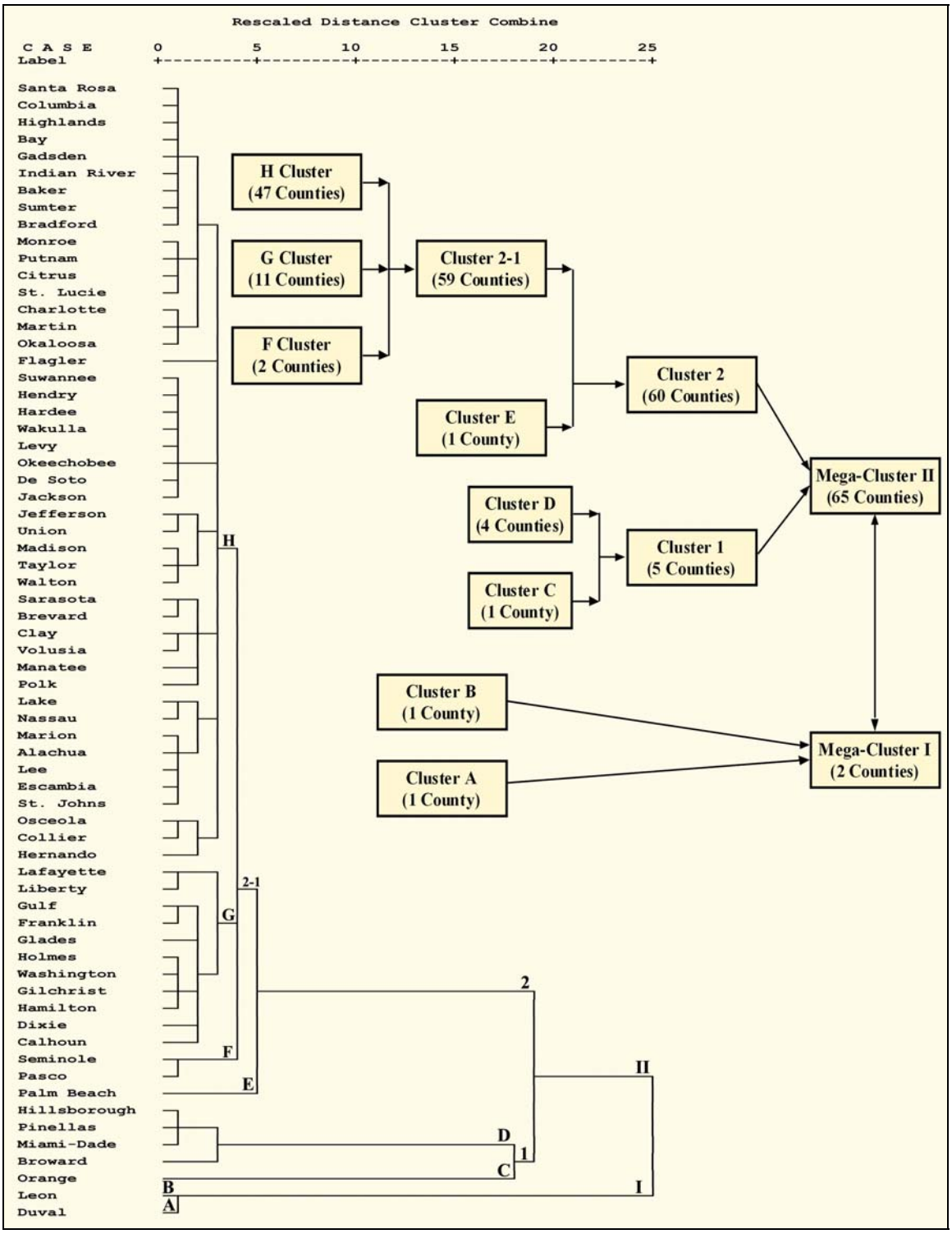


Figure 5.3 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Florida, 1995 – 2000

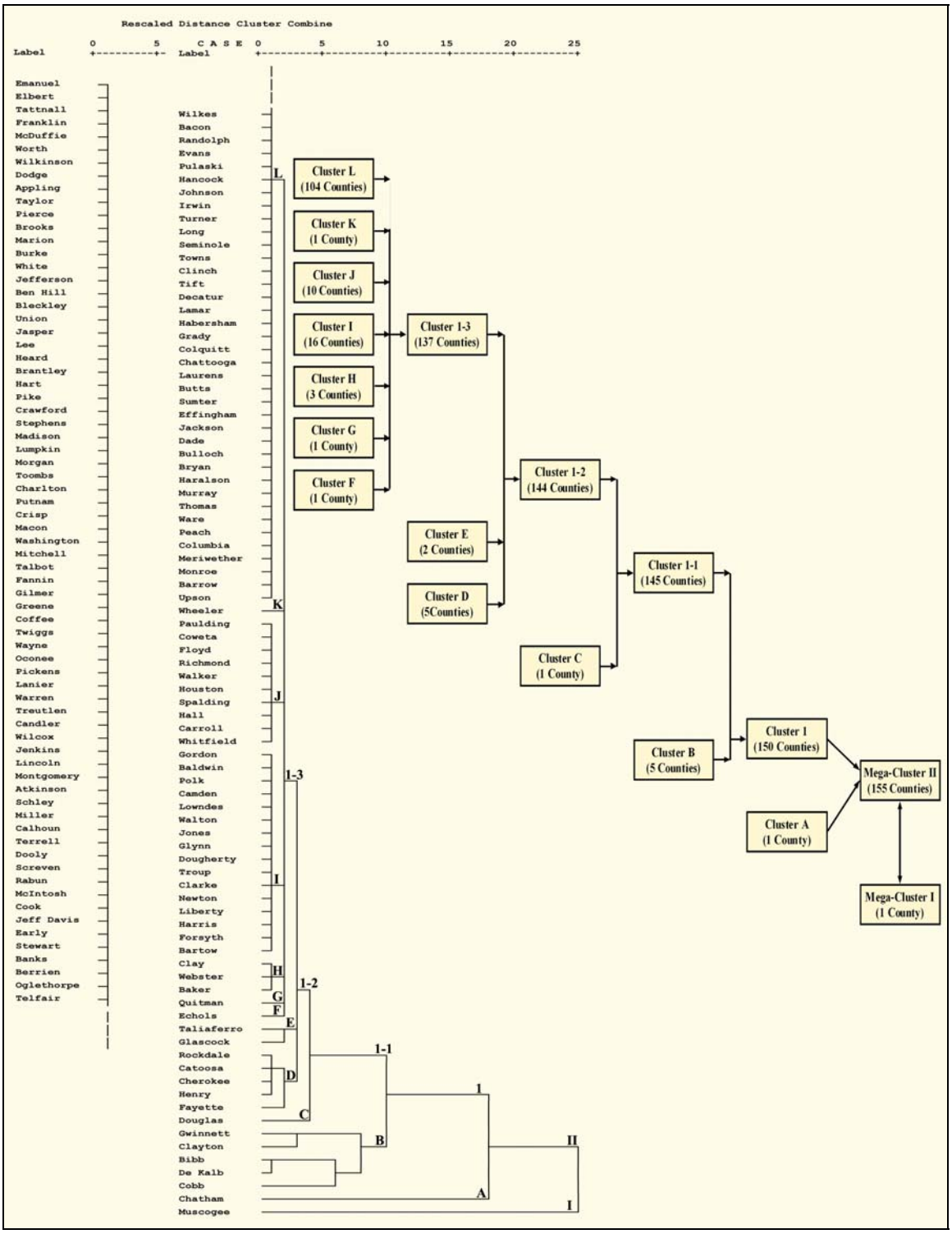


Figure 5.4 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Georgia, 1995 – 2000

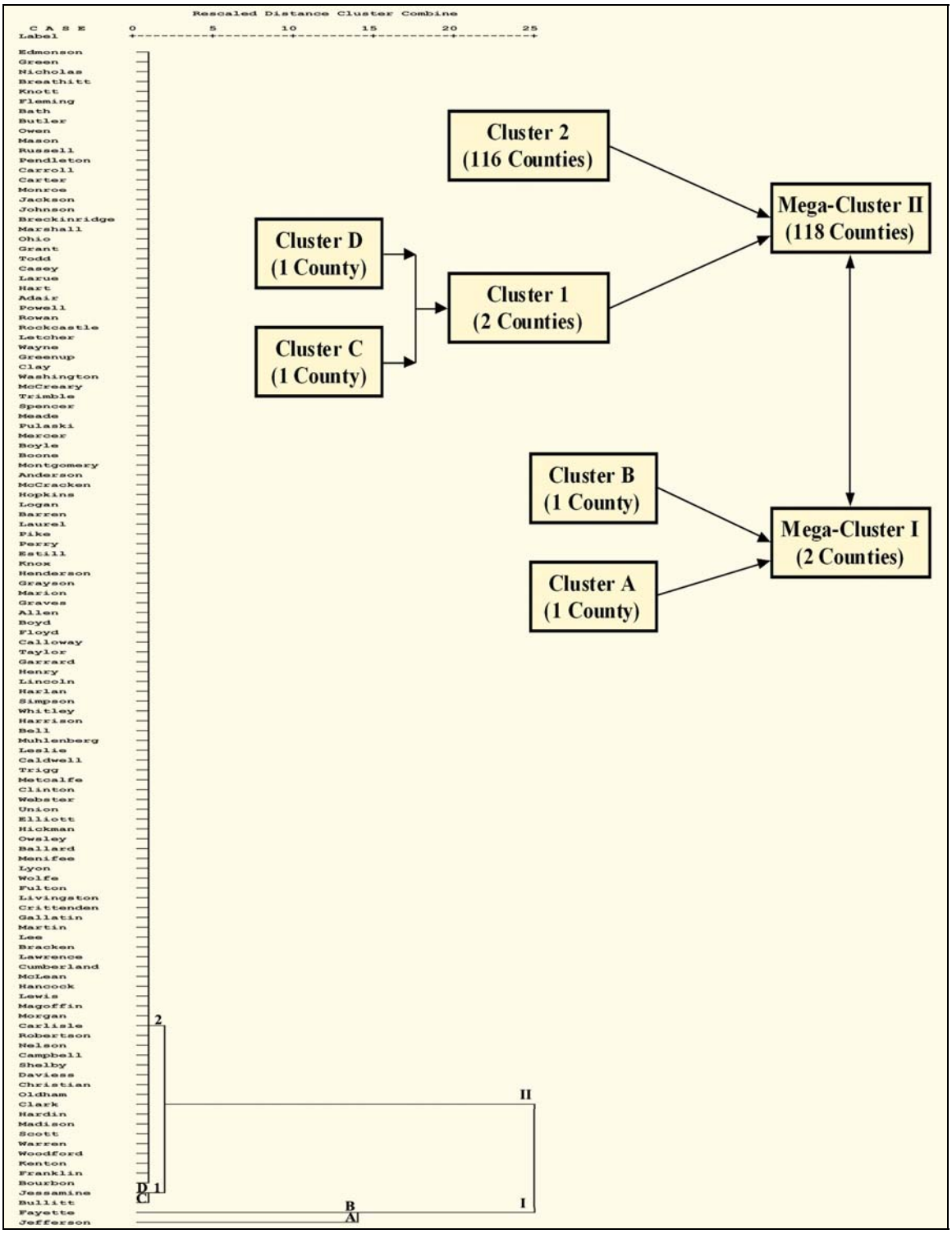


Figure 5.5 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Kentucky, 1995 – 2000

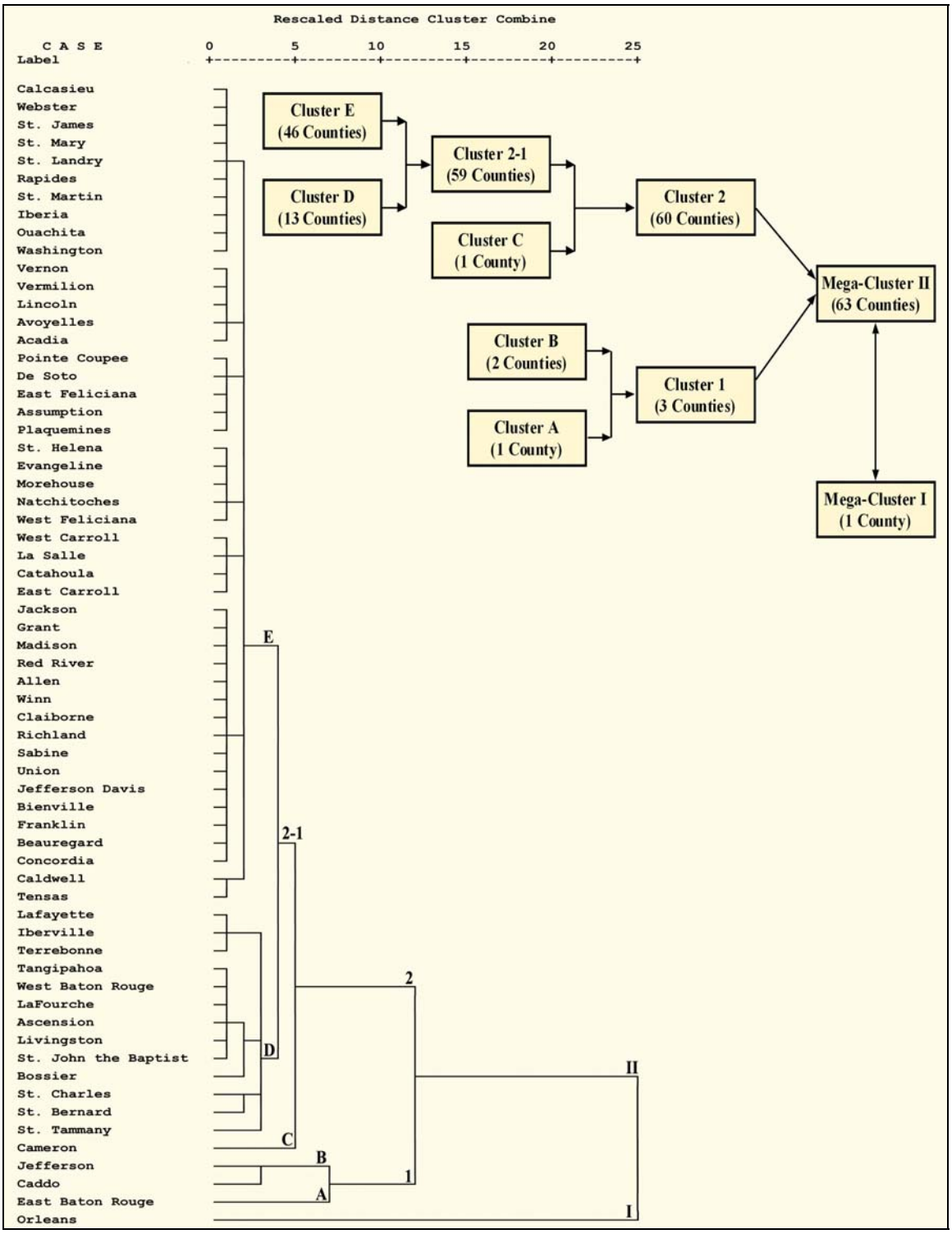


Figure 5.6 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Louisiana, 1995 – 2000

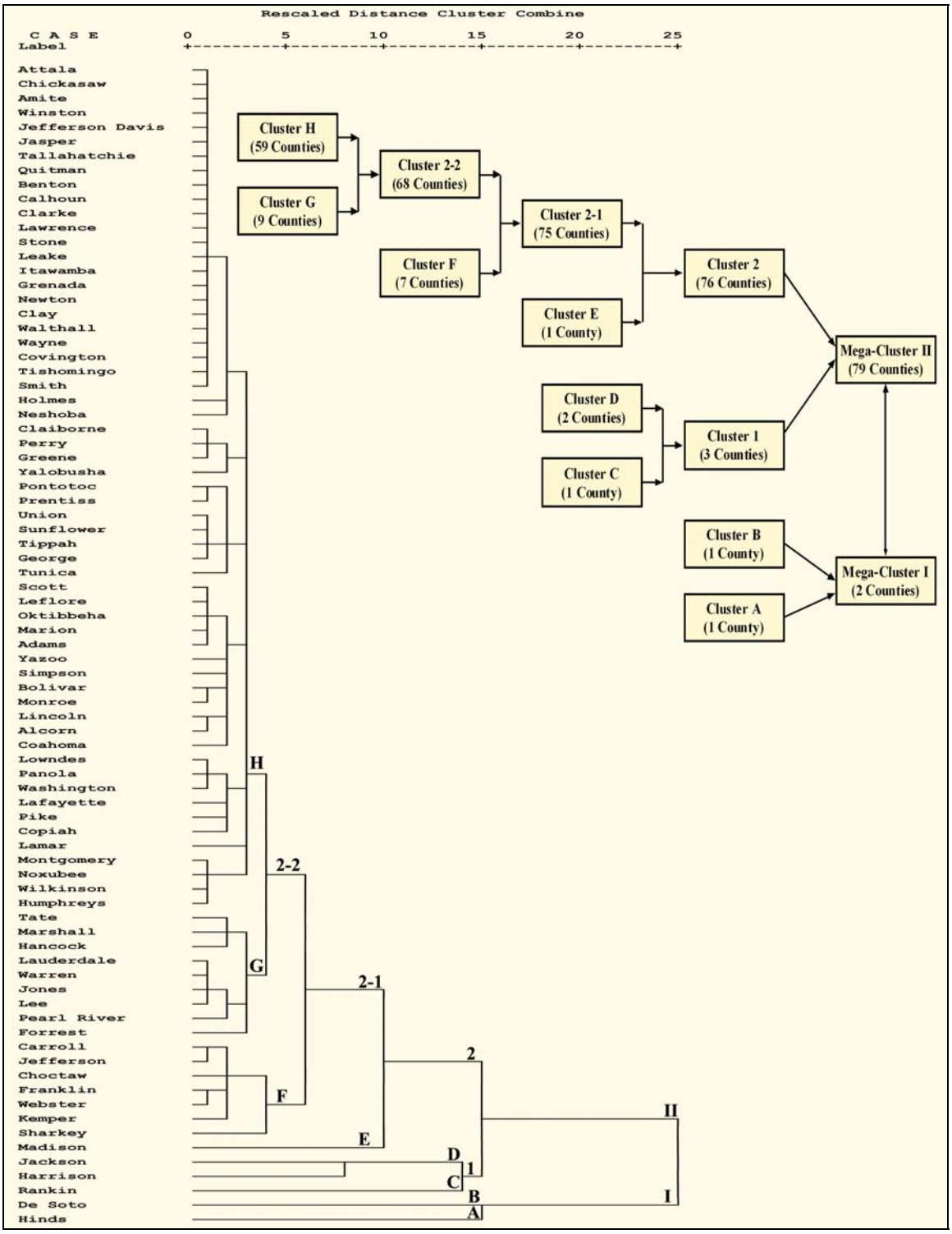


Figure 5.7 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Mississippi, 1995 – 2000

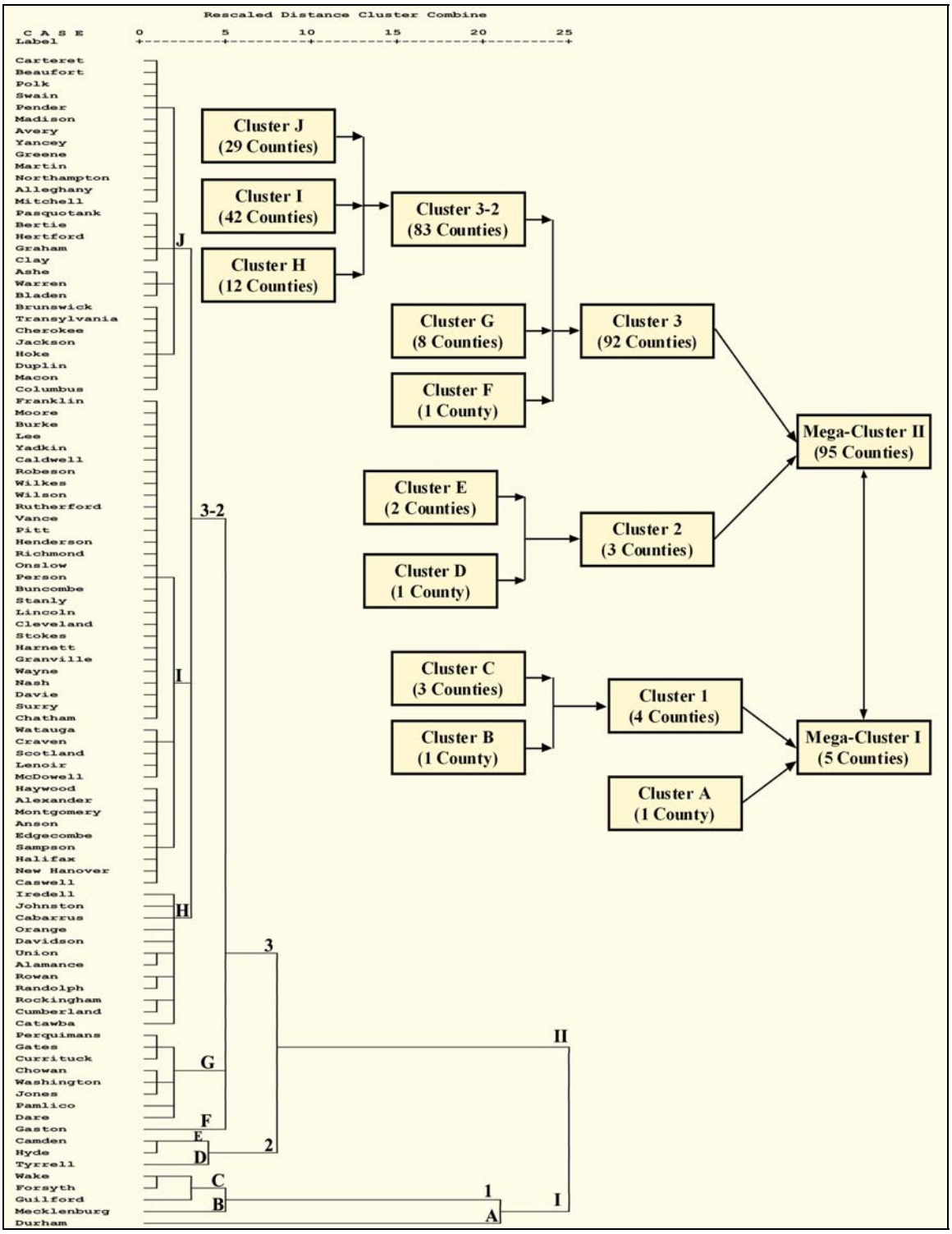


Figure 5.8 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of North Carolina, 1995 – 2000

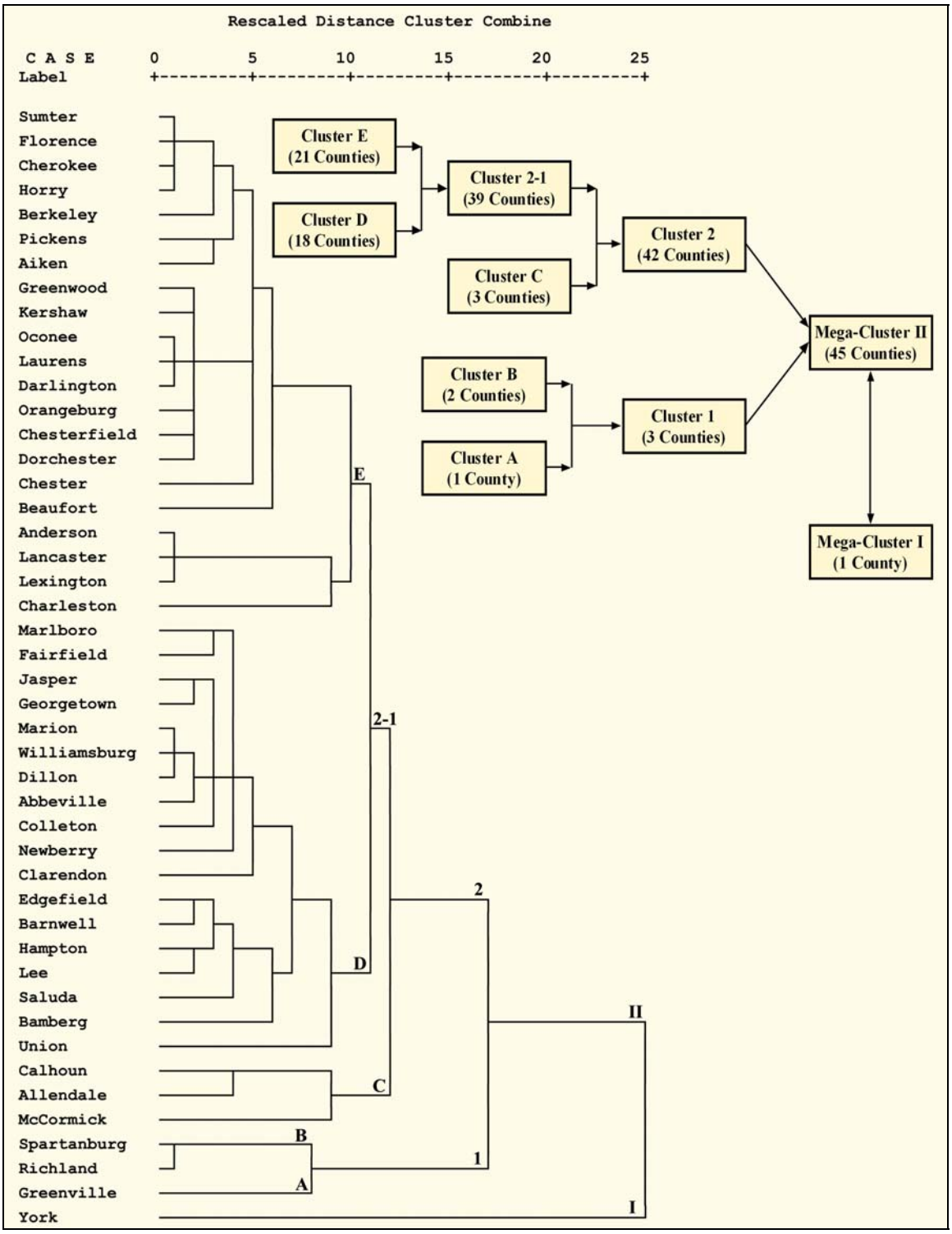


Figure 5.9 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of South Carolina, 1995 – 2000

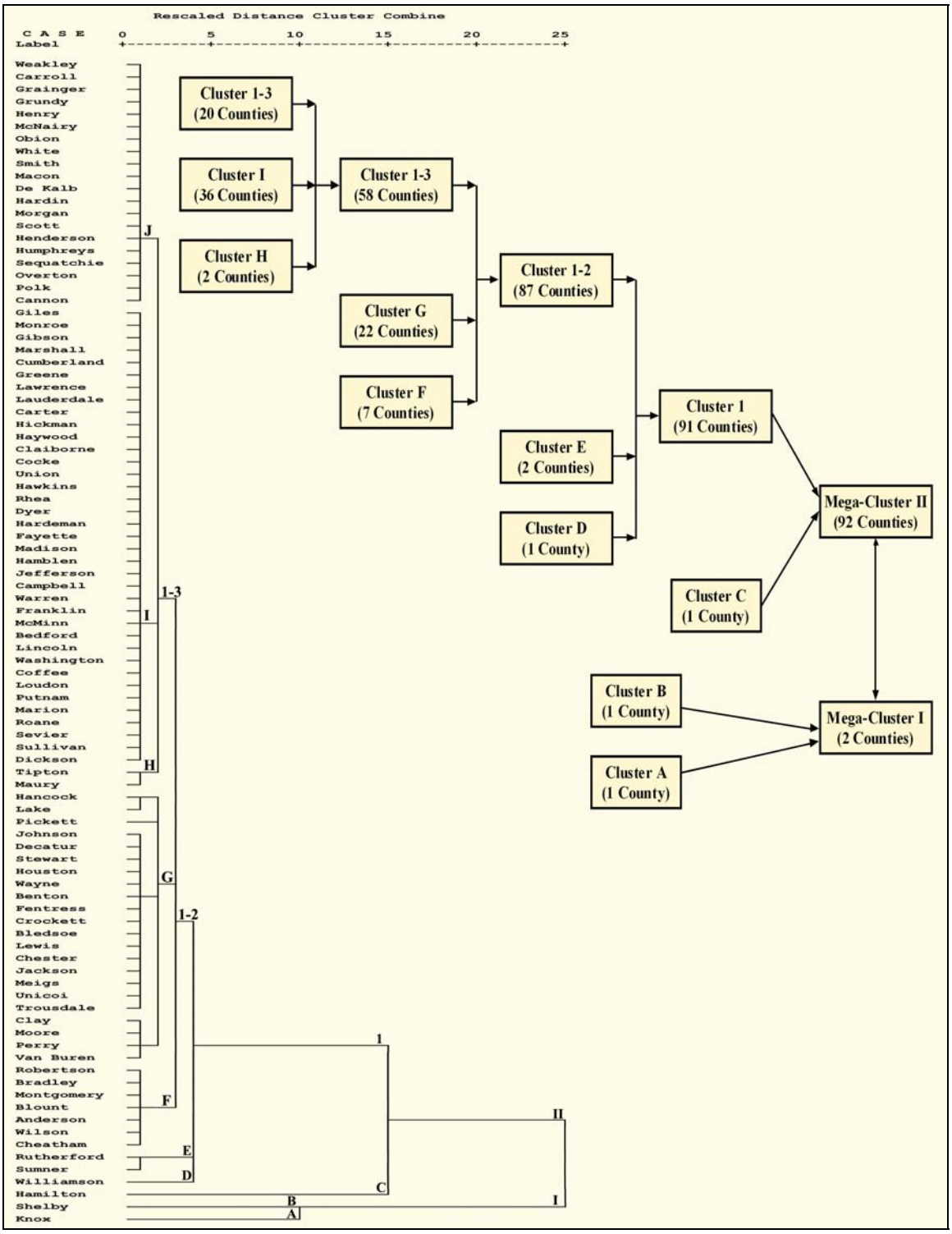


Figure 5.10 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of Tennessee, 1995 – 2000

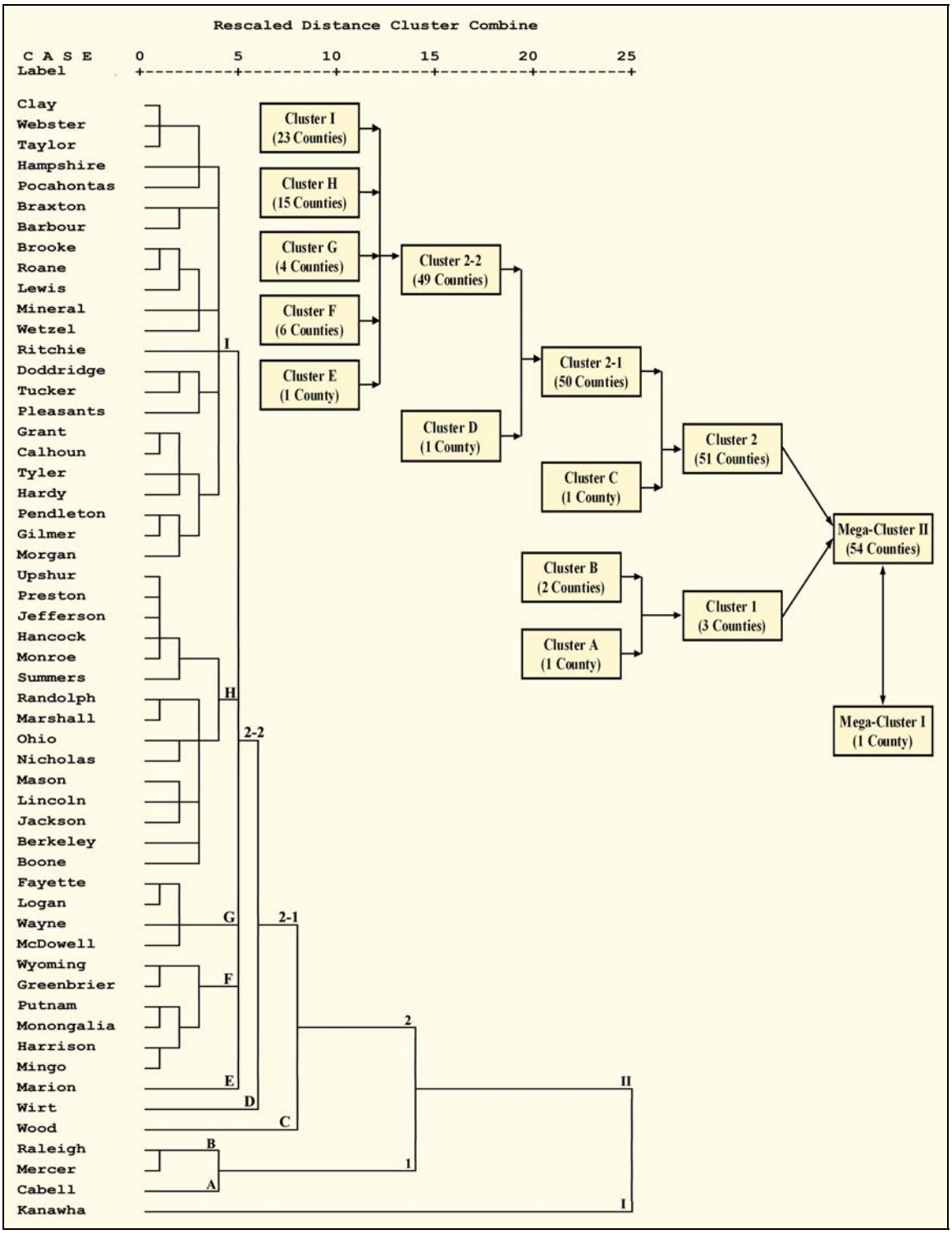


Figure 5.11 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Economic Growth of West Virginia, 1995 – 2000

5.1.2 Spatial Autocorrelation Analysis for Economic Growth Factor

Figure 5.12 shows a map of the spatial distribution (spatial cluster and spatial outliers) of the economic growth factors and the Global Moran I for Alabama. The LISA map and Moran scatterplots are employed to visualize and contrast the distribution of the data and the extent of their local and global spatial autocorrelation. The Moran scatterplot visualizes the type and strength of spatial autocorrelation in the economic growth factor data distribution. The Moran scatterplot regresses a spatially lagged transformation of an economic growth factor (y-axis) on the original economic growth factor (x-axis). The slope of the scatterplot corresponds to the value for Moran's I for Alabama, which is 0.4013. This is a measure of the global spatial autocorrelation, or the overall clustering in the economic growth factor dataset. The results of the spatial autocorrelation analysis show that the Moran's I had a highly positive spatial autocorrelation in the overall dataset. The positive spatial autocorrelation means that the observation's value in relation to its neighbor is high-high and low-low clusters. In other words, the data is located in the first and third quadrants of Moran's scatterplot. This is shown in the LISA map, which provides the spatial clusters and outliers. There are 10 counties in the high-high location shown in red; these are the hot spots, which mean that there are statistically significant high economic growth characteristics. These 10 counties are part of the Huntsville-Decatur, AL MSA, Birmingham-Hoover-Cullman, AL MSA, and Montgomery-Alexander City, AL MSA. There are 8 counties in the low-low locations; these areas are cold spots, which mean there are statistically significant low economic growth characteristics. They are in western Alabama, and most of them are urban 6 & 7 and rural counties. Winston County has a rose color in a map, which means

that it is a high-low county; this county has a statistically significant high economic growth characteristic, but its neighboring counties have low economic growth characteristics. The counties that are of the white color are not statistically significant. The rest of the states provided follow the same type of analysis as provided for Alabama.

Summary: Based on the results of the spatial autocorrelation analysis for the economic growth variables, the following conclusions are made.

1) The range of Moran's I is from 0.2421 for Florida to 0.7987 for Georgia with a mean of 0.5582, which has a positive spatial autocorrelation for each state. This means that the observation's values in relation to it's neighbor are high-high and low-low; in other words, there are clusters of hot spots and cold spots, where hot spots represent faster economic growth and cold spots represent a decline in economic growth.
2) For economic growth, the interstate highways, large cities (with a population over 100,000), and capital cities have strong influence toward higher economic growth. The overall map for the Southeast is shown in Chapter VI.

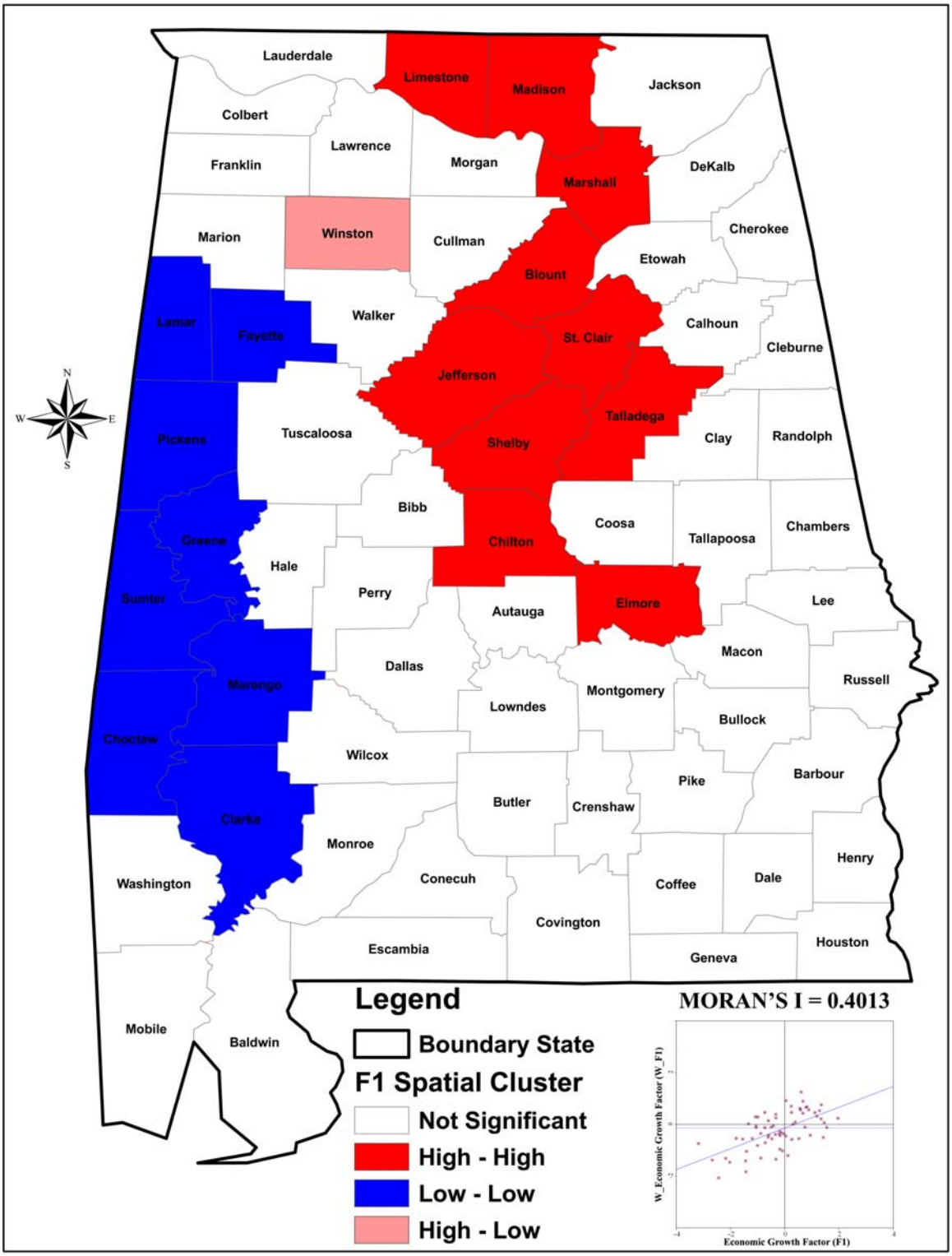


Figure 5.12 Spatial Autocorrelation Results for the Economic Growth Factor of Alabama, 1995 – 2000

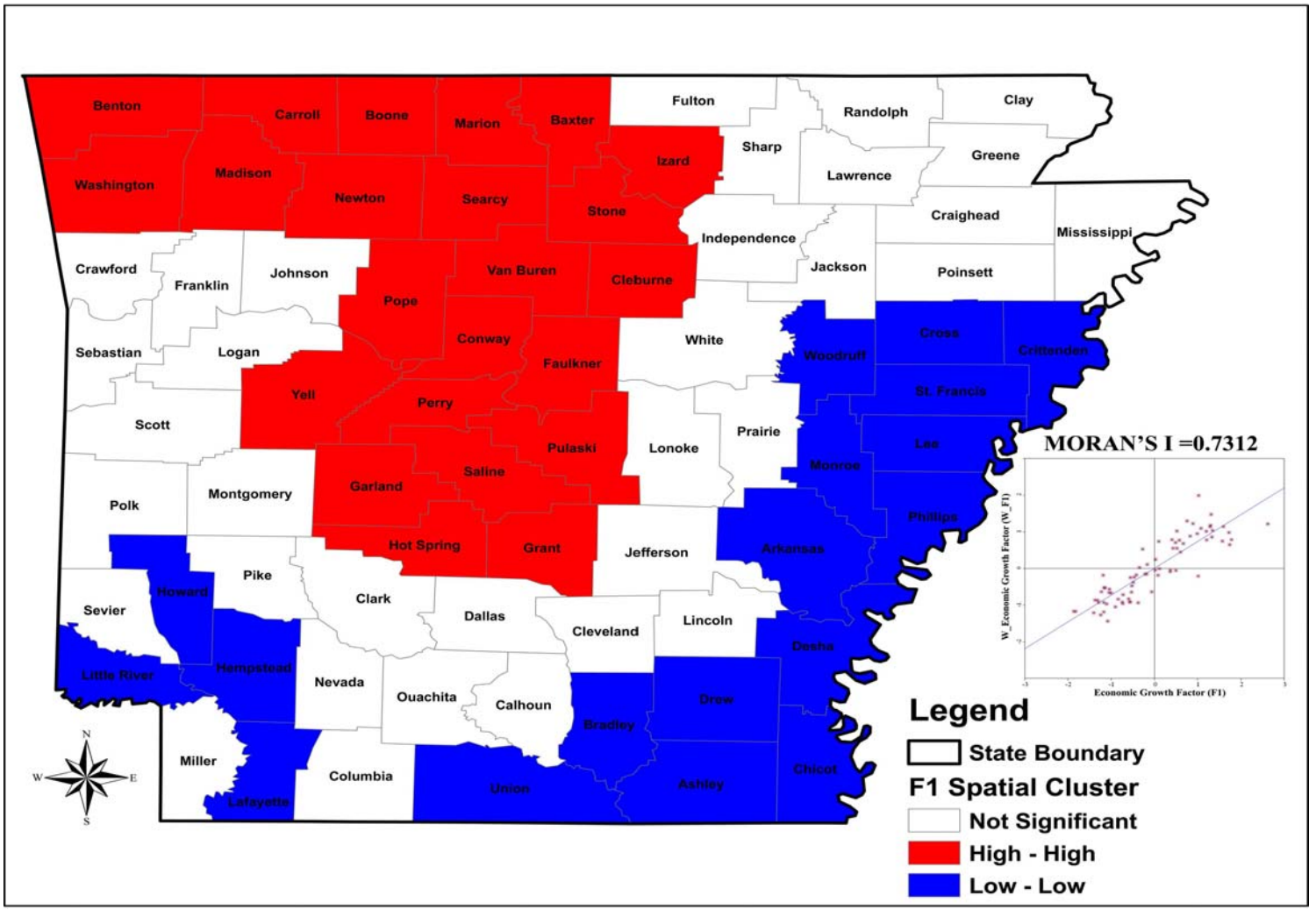


Figure 5.13 Spatial Autocorrelation Results for the Economic Growth Factor of Arkansas, 1995 – 2000

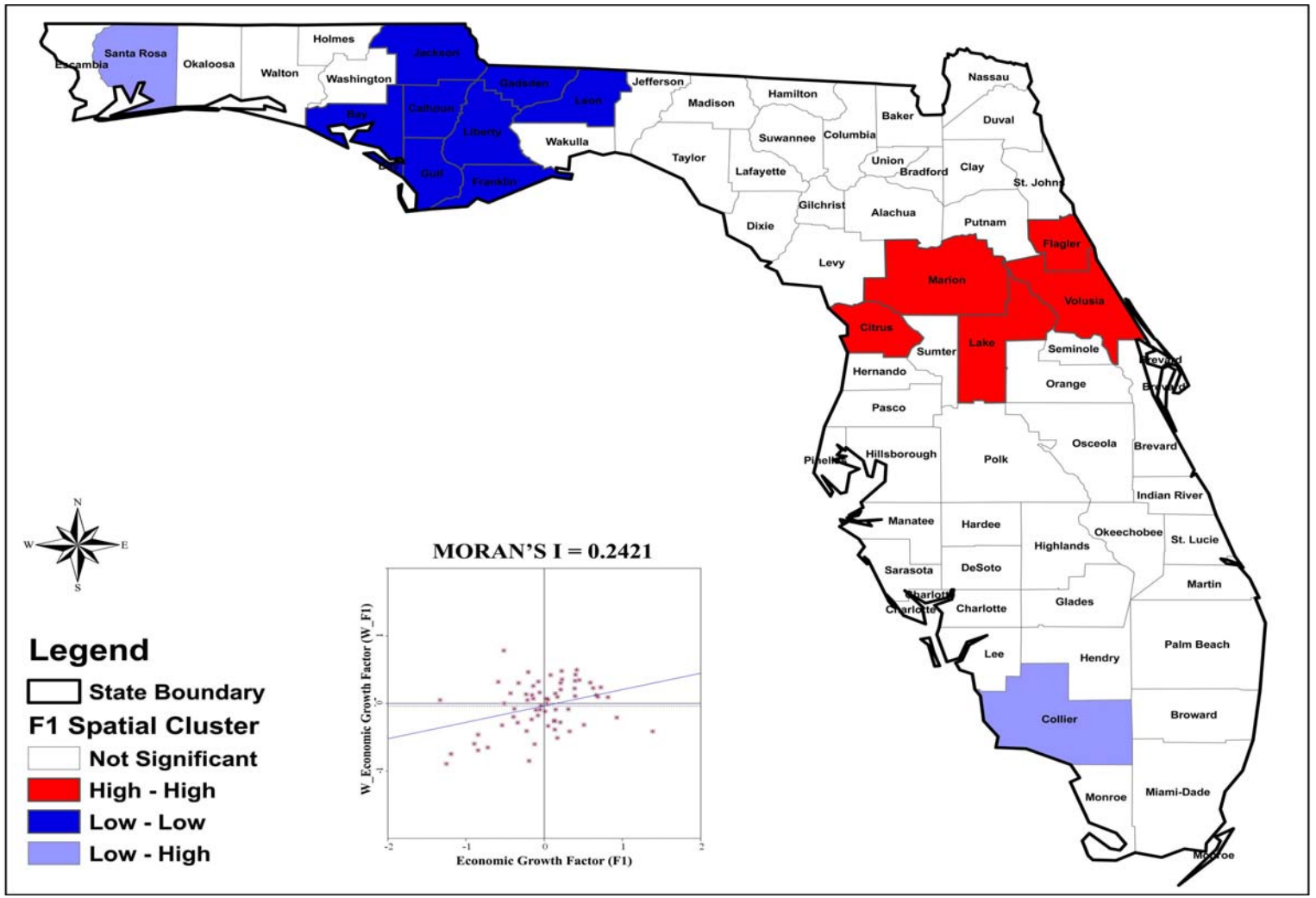


Figure 5.14 Spatial Autocorrelation Results for the Economic Growth Factor of Florida, 1995 – 2000

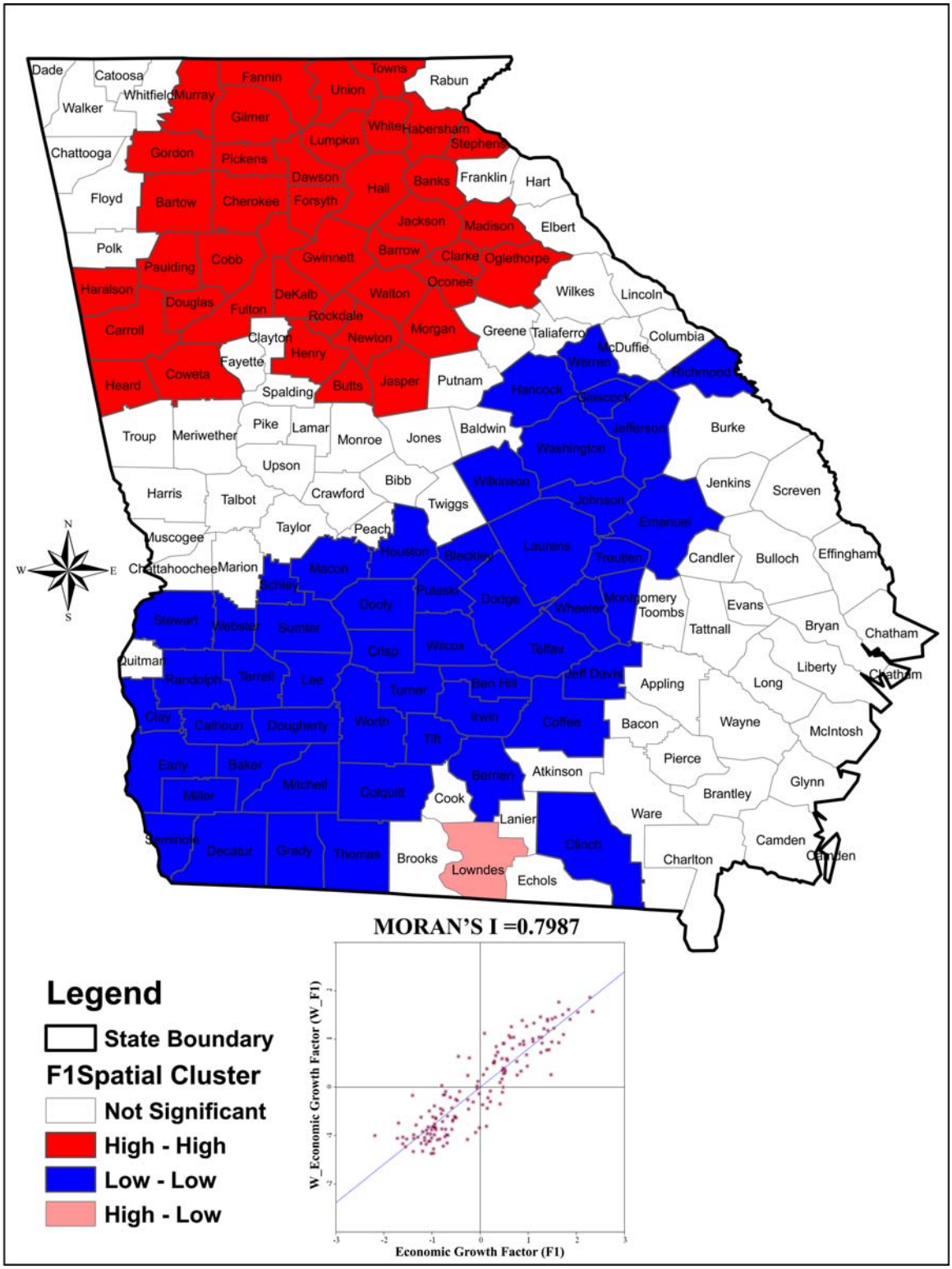


Figure 5.15 Spatial Autocorrelation Results for the Economic Growth Factor of Georgia, 1995 – 2000

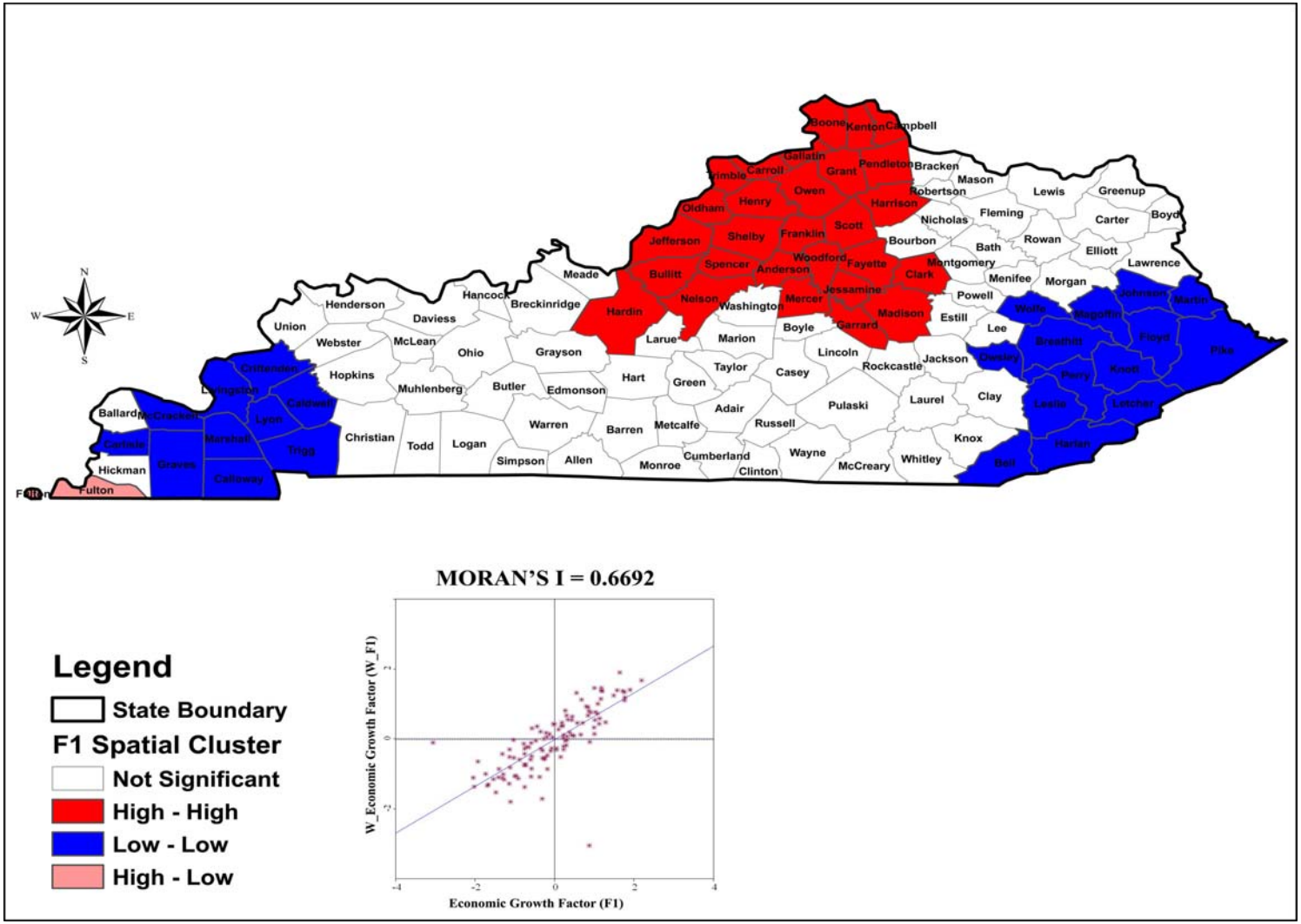


Figure 5.16 Spatial Autocorrelation Results for the Economic Growth Factor of Kentucky, 1995 – 2000

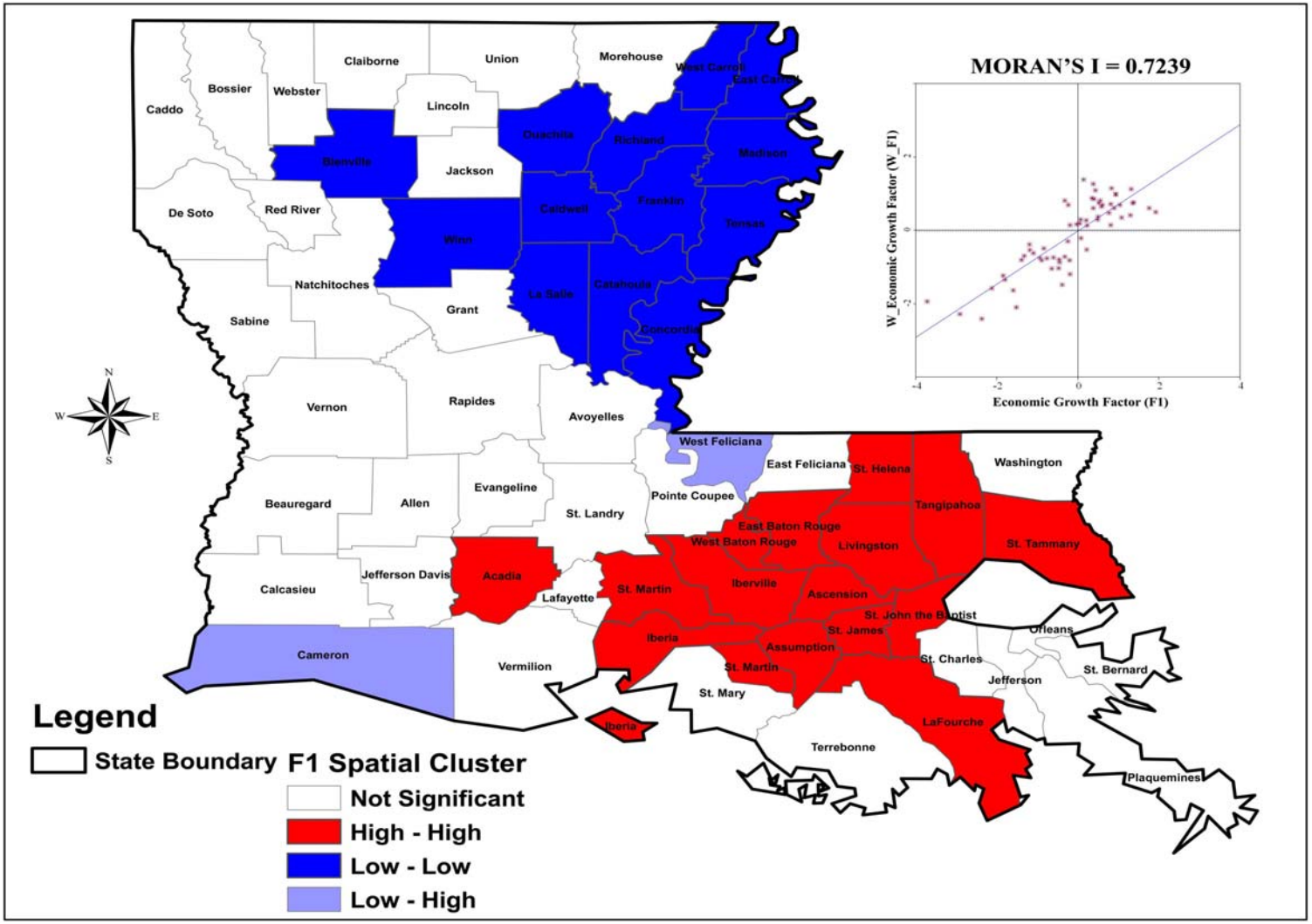


Figure 5.17 Spatial Autocorrelation Results for the Economic Growth Factor of Louisiana, 1995 – 2000

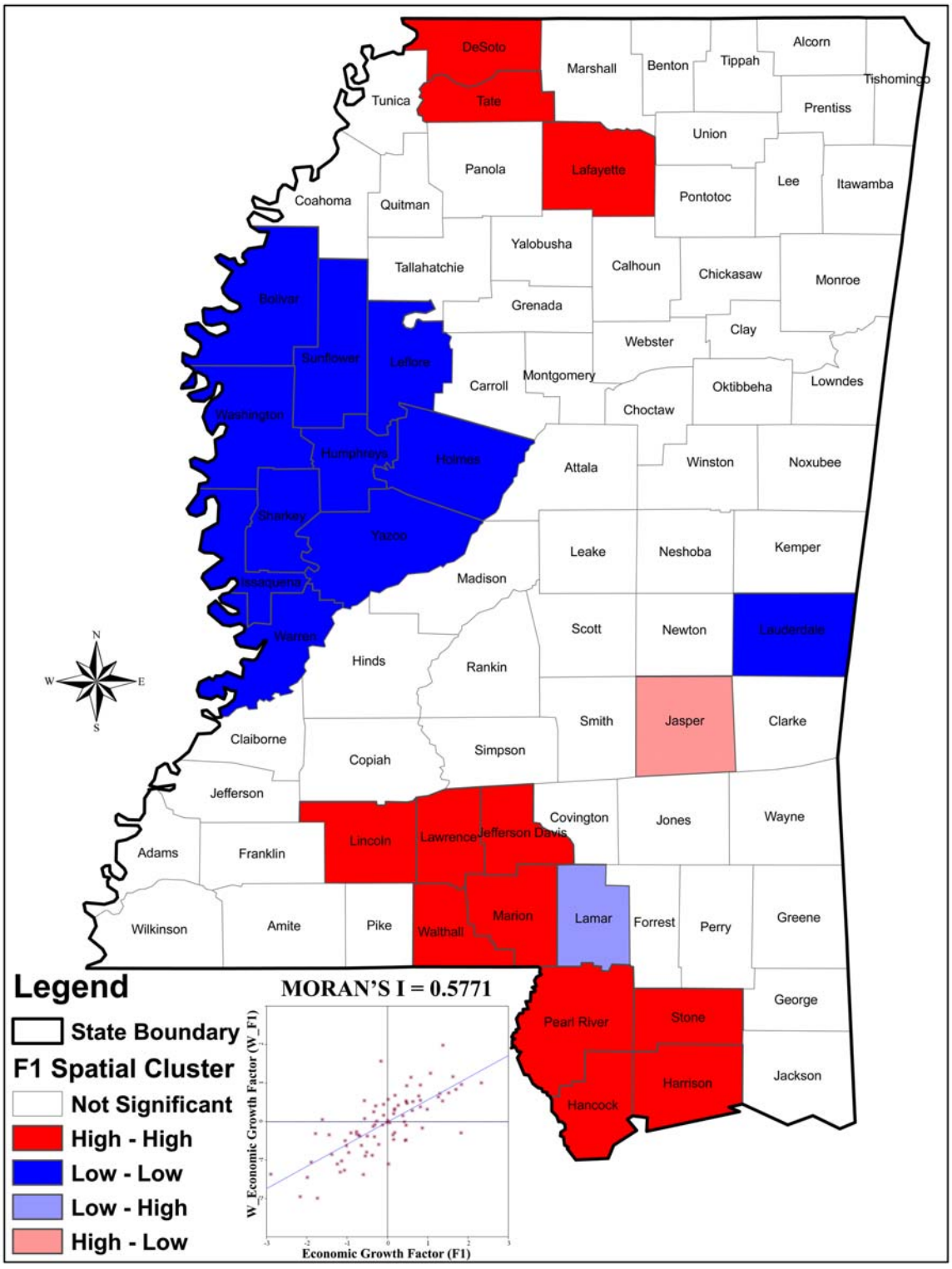


Figure 5.18 Spatial Autocorrelation Results for the Economic Growth Factor of Mississippi, 1995 – 2000

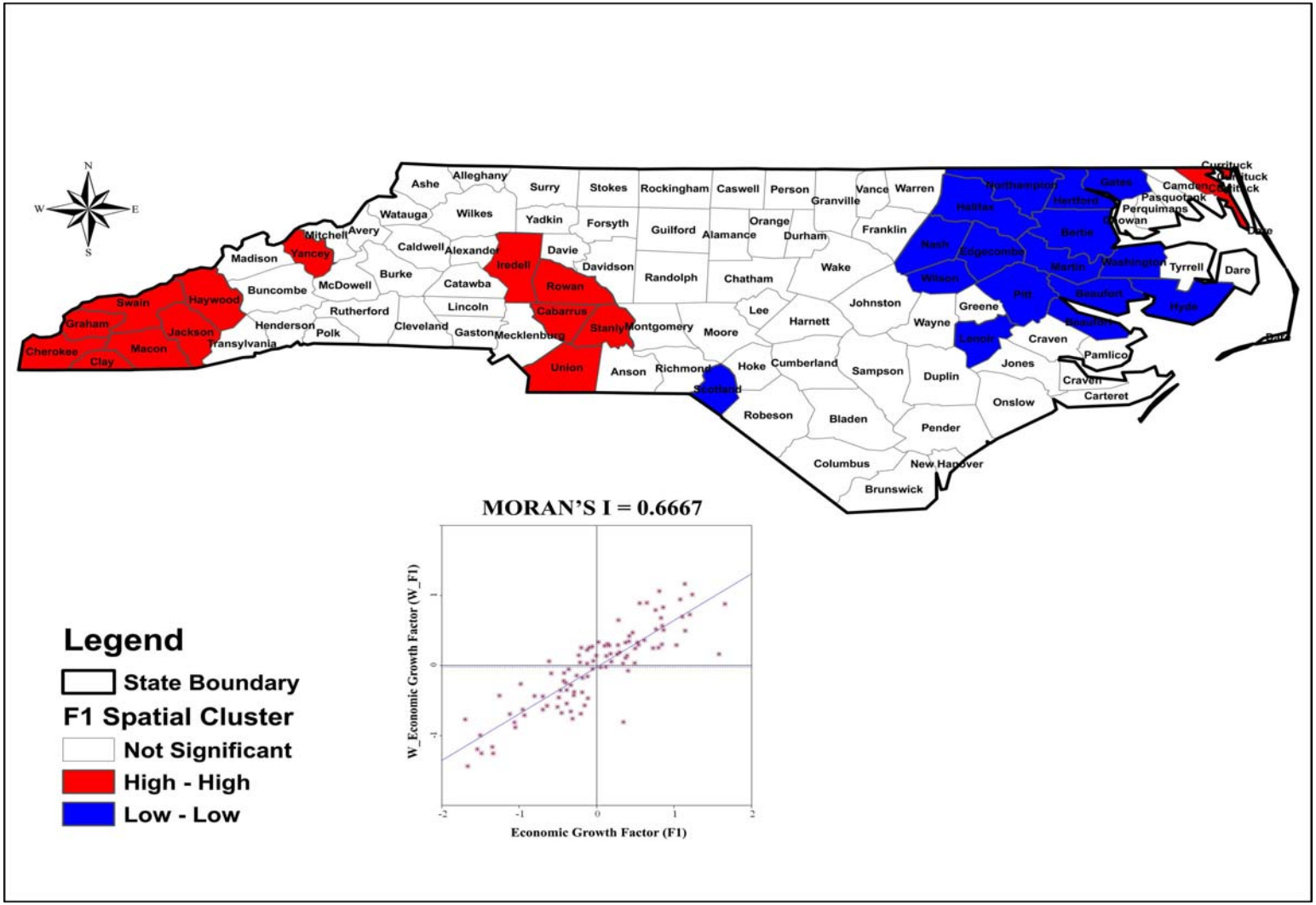


Figure 5.19 Spatial Autocorrelation Results for the Economic Growth Factor of North Carolina, 1995 – 2000

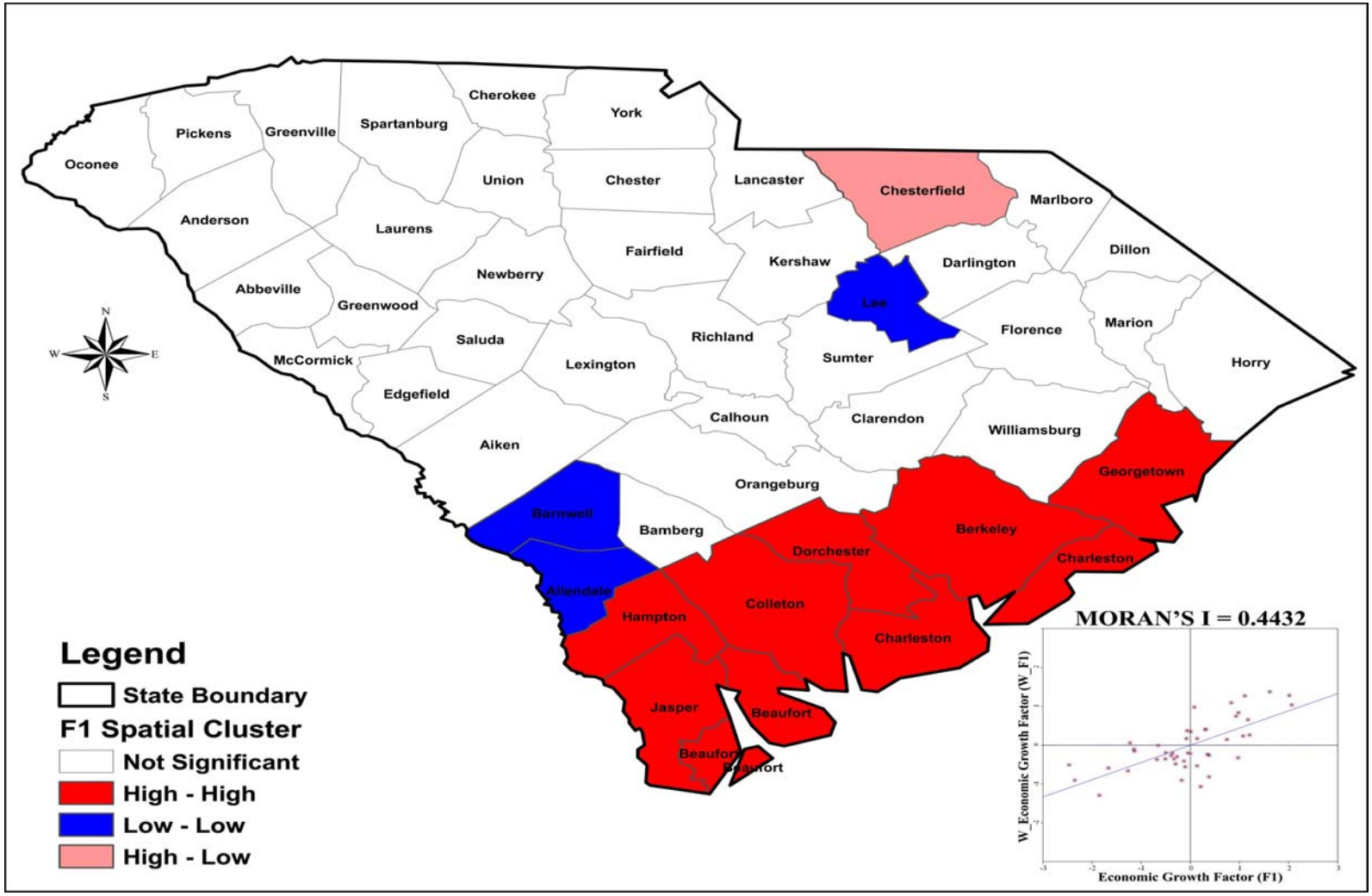


Figure 5.20 Spatial Autocorrelation Results for the Economic Growth Factor of South Carolina, 1995 – 2000

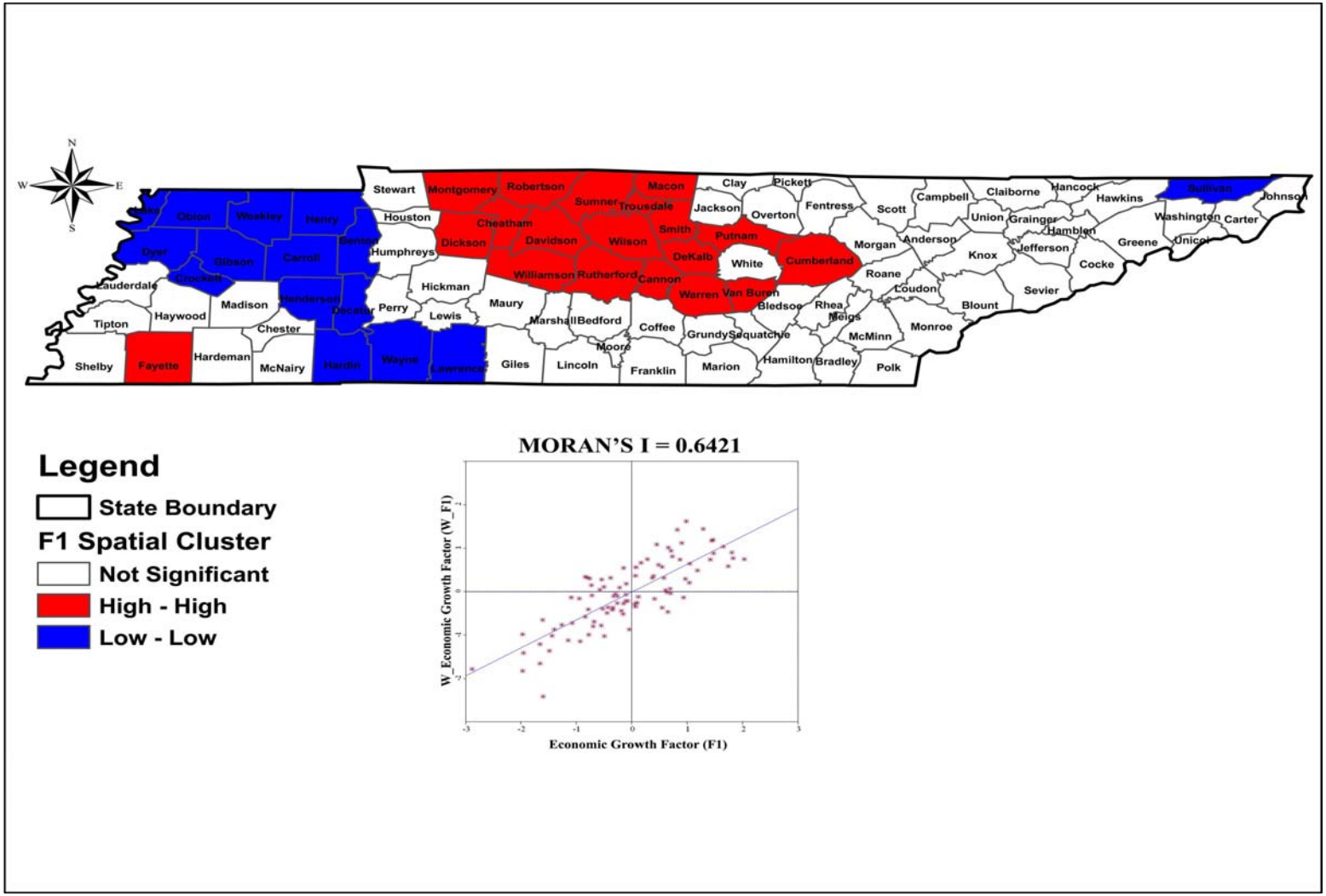


Figure 5.21 Spatial Autocorrelation Results for the Economic Growth Factor of Tennessee, 1995 – 2000

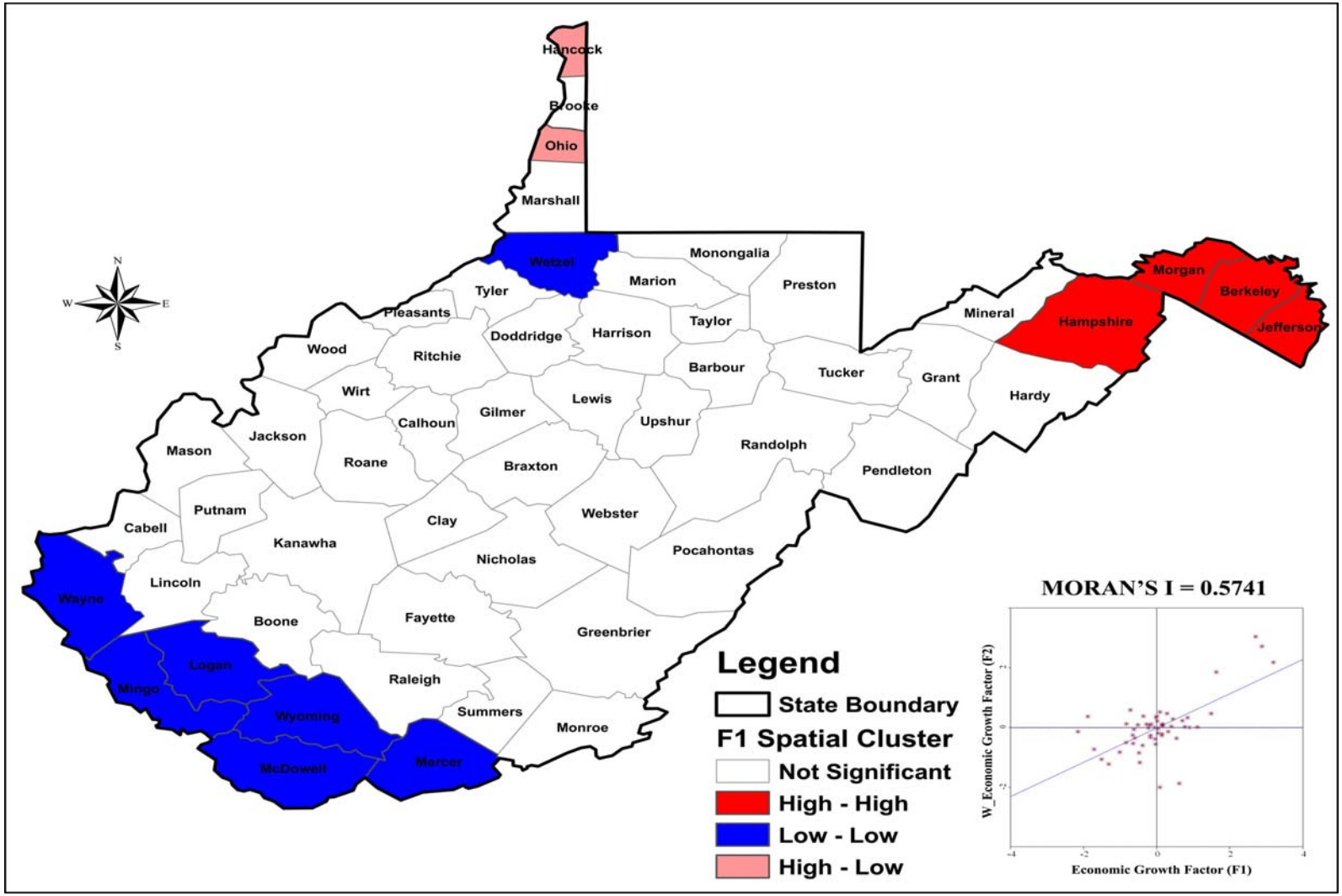


Figure 5.22 Spatial Autocorrelation Results for the Economic Growth Factor of West Virginia, 1995 – 2000

5.1.3 Hierarchical Cluster Analysis for Population Growth Factor

Results (dendrogram and compressed figure) for the hierarchical cluster analysis for population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*) with consideration of the large cities' gravity (*LNGRAV*) for each state are illustrated in Figure 5.23 through Figure 5.33. The results for the hierarchical cluster analysis for population growth of Alabama follow. The rest of the states provided follow the same type of analysis as provided for Alabama.

Alabama: Figure 5.23 illustrates the dendrogram for the population growth variables' hierarchical cluster analysis of the states of Alabama as an example for illustration. From Figure 5.23, the highest rescaled distances for each of twelve counties are single county clusters. These include Cluster A (Jefferson County in Birmingham-Hoover-Cullman MSA), Cluster B (Madison County in Huntsville-Decatur, AL MSA), Cluster C (Mobile County in Mobile-Daphne-Fairhope, AL MSA), Cluster D (Montgomery County in Montgomery, AL MSA), Cluster E (Shelby County in Birmingham-Hoover-Cullman, AL MSA), Cluster F (Lee County in urban 4 & 5), Cluster G (Elmore County in Montgomery, AL MSA), Cluster H (Baldwin County in Mobile-Daphne-Fairhope, AL MSA), Cluster I (Morgan County in Huntsville-Decatur, AL MSA), Cluster J (Tuscaloosa County in Tuscaloosa, AL MSA), Cluster K (Chilton County in urban 6 & 7), and Cluster L (Dallas County in urban 4 & 5). These clusters are dissimilar to each other, or they have their own individual population growth characteristics; therefore they are single clusters.

At an aggregated level, Madison County (Cluster B), Mobile County (Cluster C), and Montgomery County (Cluster D) have similar population growth characteristics;

therefore, these three counties build up a loose Cluster 1. Loose Cluster 1 and Cluster A (Jefferson County) build up to Mega Cluster I. Counties in Mega Cluster I are all metropolitan counties, and the most populated counties in Alabama, but they do not have rapid population growth from 1995 to 2000 when compared to other metropolitan counties. The reason is that these counties have the highest rescaled distances in the dendrogram in which the large cities' gravity (*LNGRAV*) has a strong influence. Therefore they become outliers in this hierarchical cluster for population growth variables analysis.

Mega Cluster II consists of single clusters: [E, F, G, H, I, J K, and L], and compact clusters. Those compact clusters are M, N, and O. M contains 57.14% counties in metropolitan areas, 14.29% urban 4 & 5 counties, and 28.57% urban 6 & 7 counties. Cluster N is Dale County in the Dothan MSA. Cluster O includes 7.5% counties in metropolitan areas, 5% urban 4 & 5 counties, 67.5% urban 6 & 7 counties (67.50%), and 20% rural counties.

Cluster E (Shelby County), Cluster F (Lee County), Cluster G (Elmore County), and Cluster H (Baldwin County) have rapid population growth compared to other counties. Cluster O has the smallest rescaled distance. For counties in Cluster O, the population growth is declining.

Summary: Based on the results of the hierarchical cluster analysis for the population growth variables, the following conclusions are made.

1) The clusters that have the highest rescaled distance (or the most dissimilar population growth characteristics) when compared to the rest of the counties are the fastest growing counties in the MSA or the outlier counties in the MSA. Most

of these counties are each single clusters. In some cases, these counties represent one or two counties that form a compact cluster.

2) In general, it was expected that most counties in low population growth clusters would also be in low economic growth clusters, and most of the counties in high population growth clusters are also in high economic growth clusters. But, the results of the hierarchical cluster analysis suggest that although population growth and economic growth have strong correlations, high population growth areas are different from high economic growth areas, and low population growth areas are different from low economic growth areas. It appears that population growth and economic growth do not only depend on each other. Some variables, like age group, race, and social development characteristics have a strong and differing influence on economic growth and population growth. This is likely to be the reason the results for the economic cluster analysis and the population cluster analysis are different.

3) The clusters that have the lowest rescaled distances are counties that were located in urban 6 & 7 counties. They also tend to have lower population growth rates.

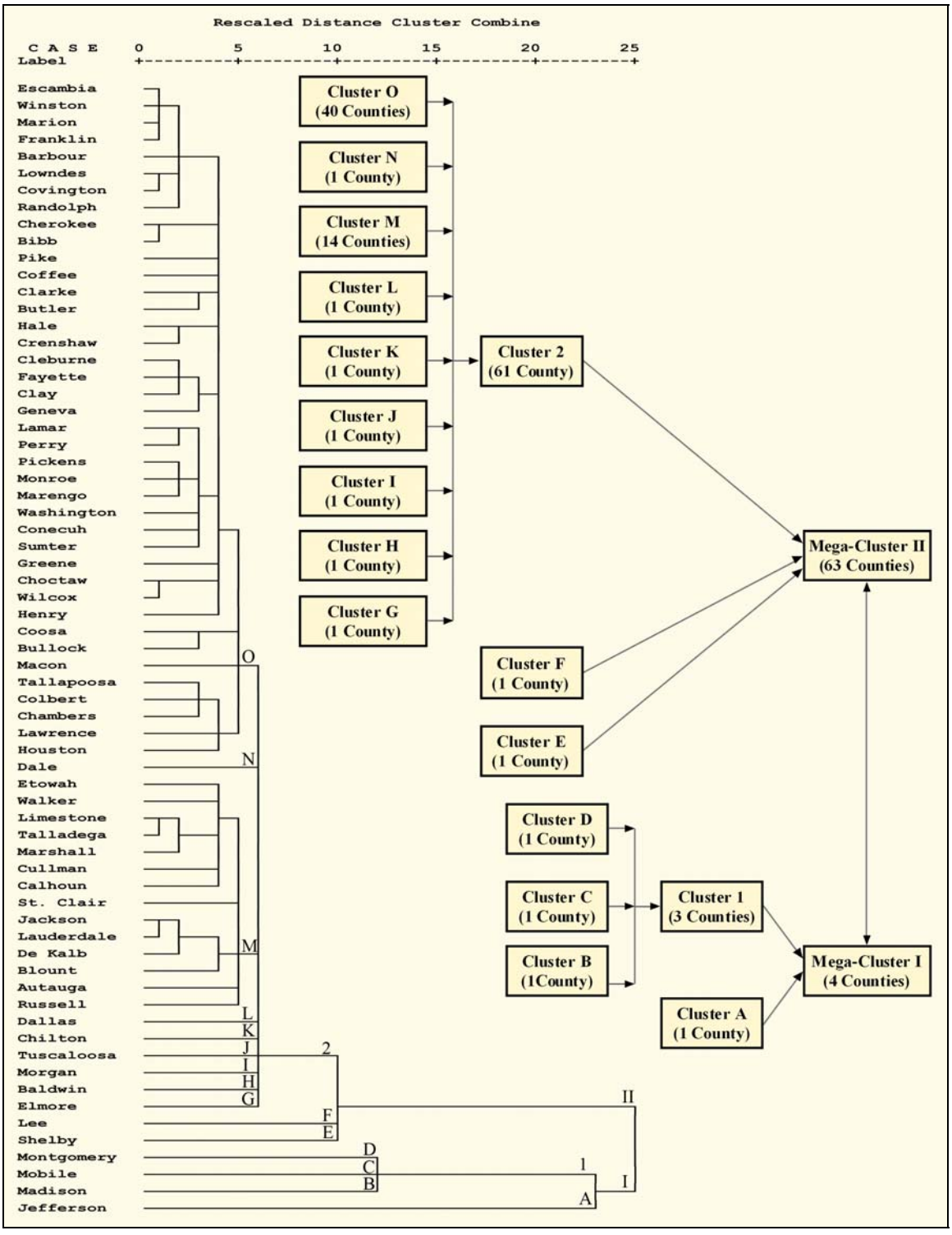


Figure 5.23 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Alabama, 1995 – 2000

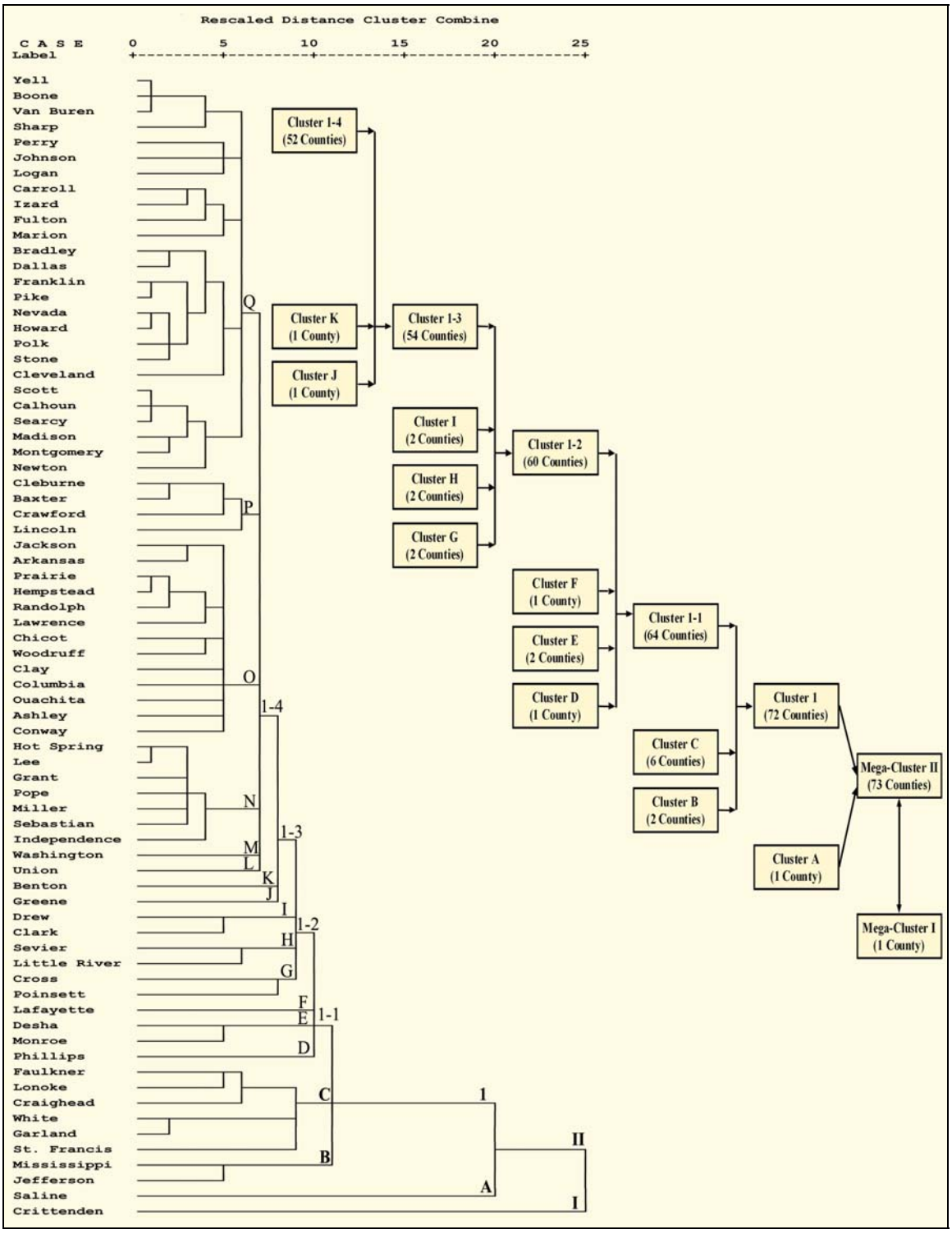


Figure 5.24 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Arkansas, 1995 – 2000

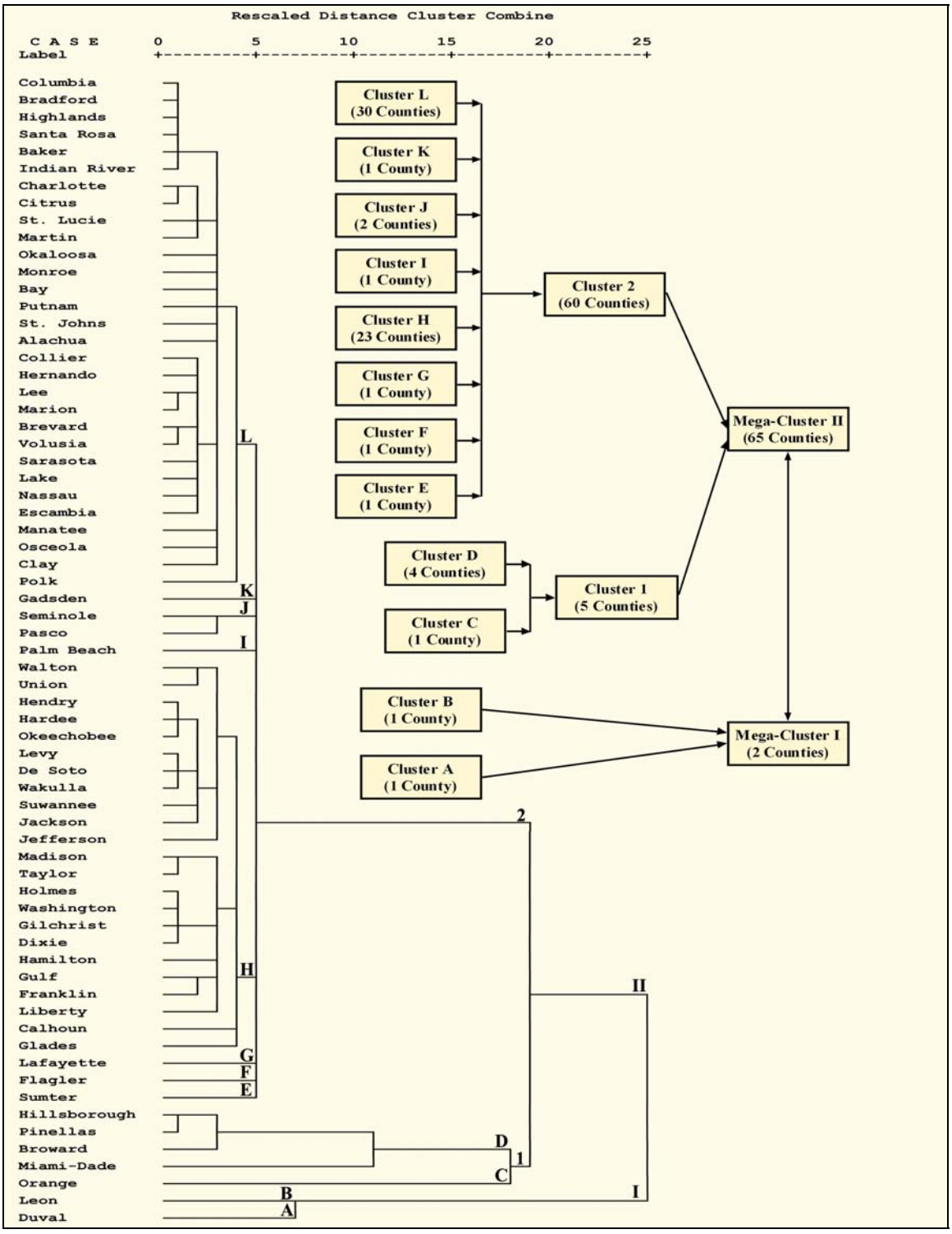


Figure 5.25 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Florida, 1995 – 2000

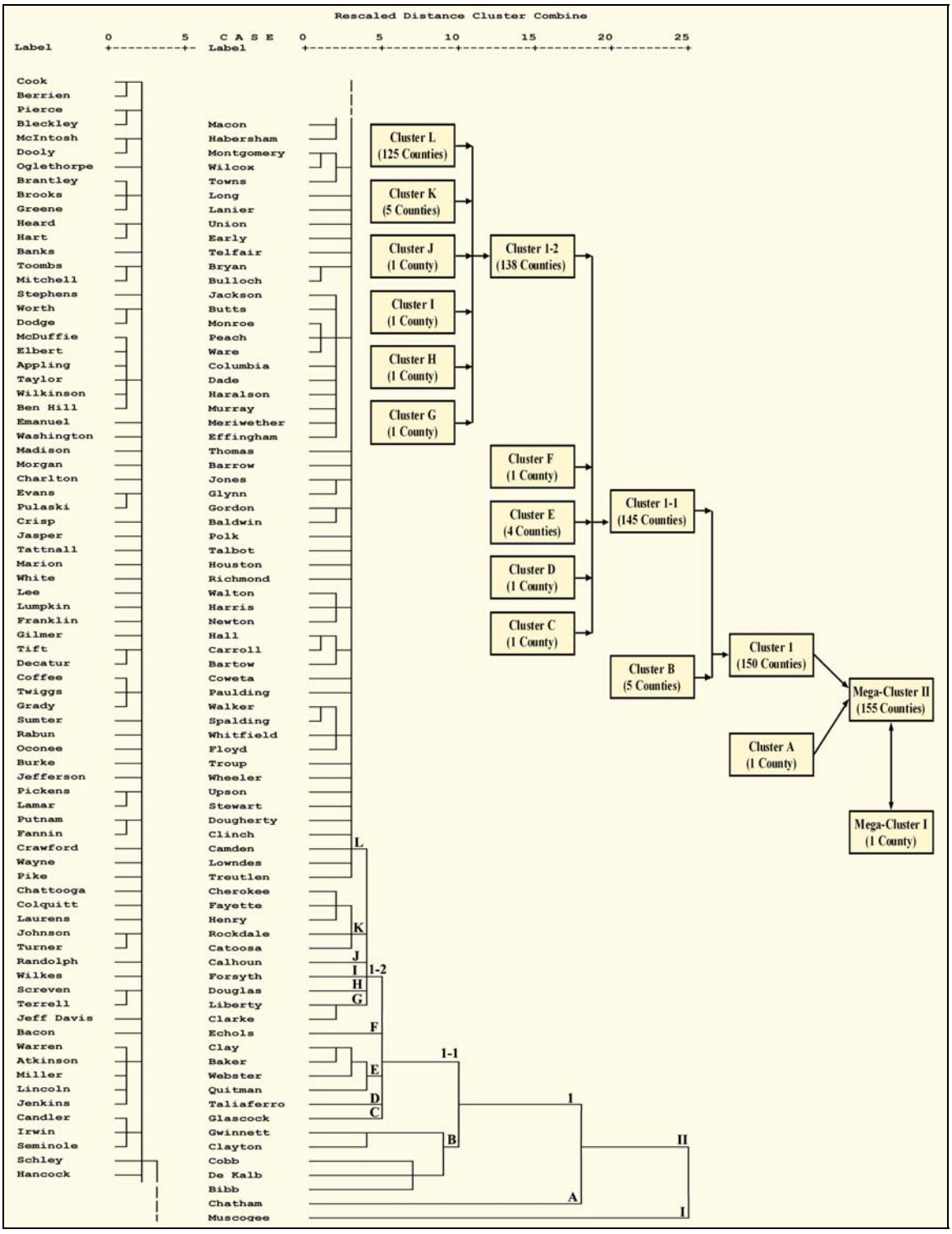


Figure 5.26 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Georgia, 1995 – 2000

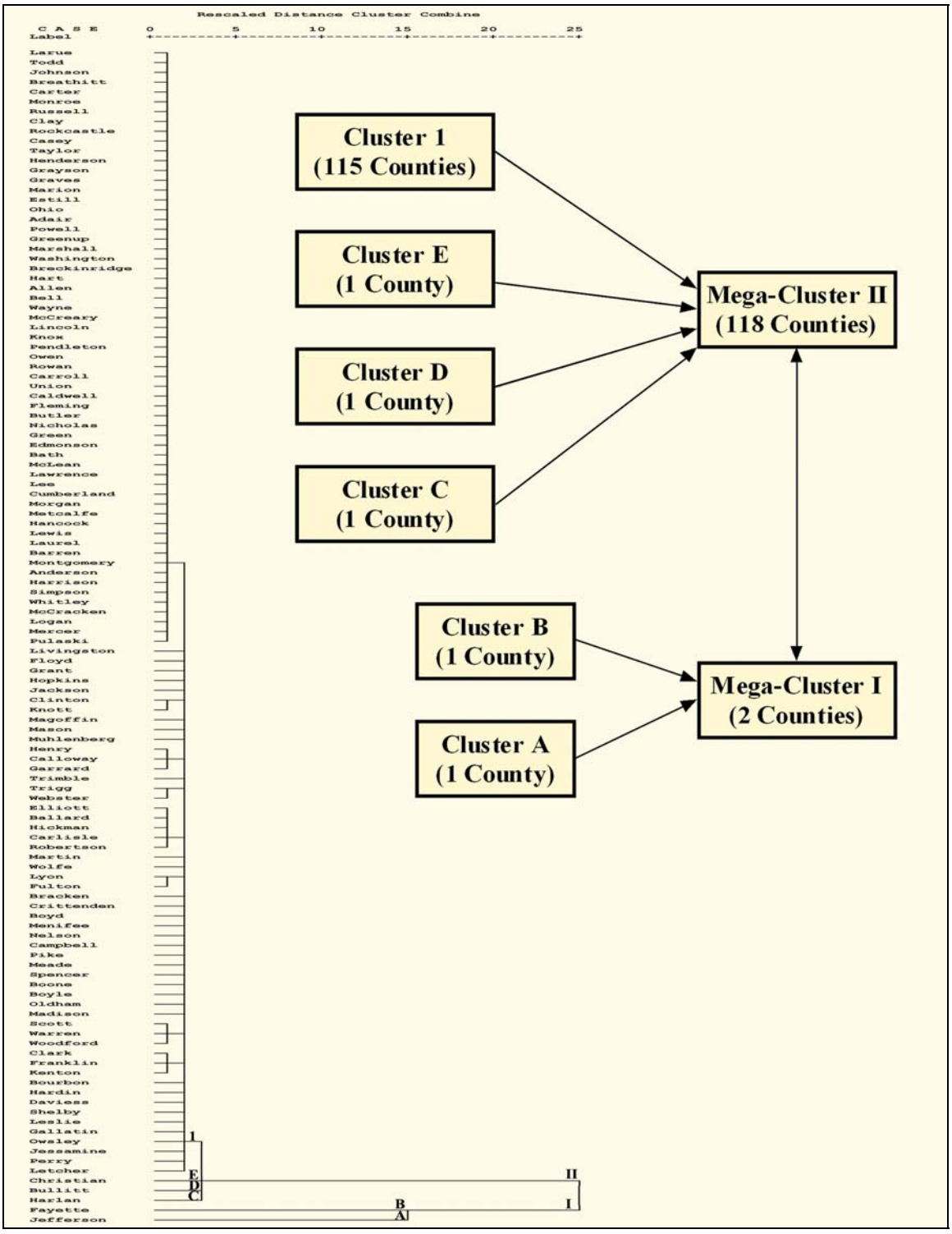


Figure 5.27 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Kentucky, 1995 – 2000

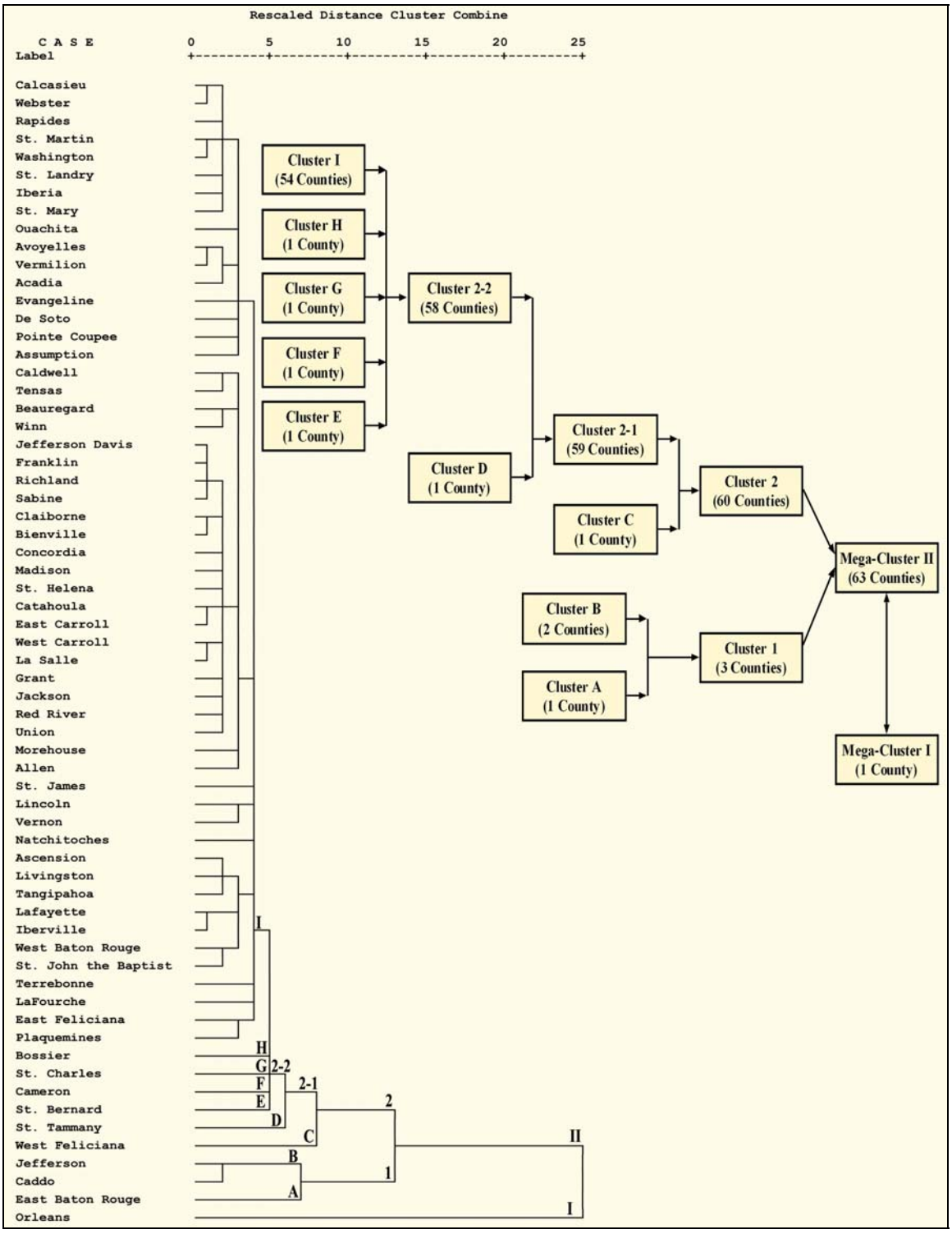


Figure 5.28 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Louisiana, 1995 – 2000

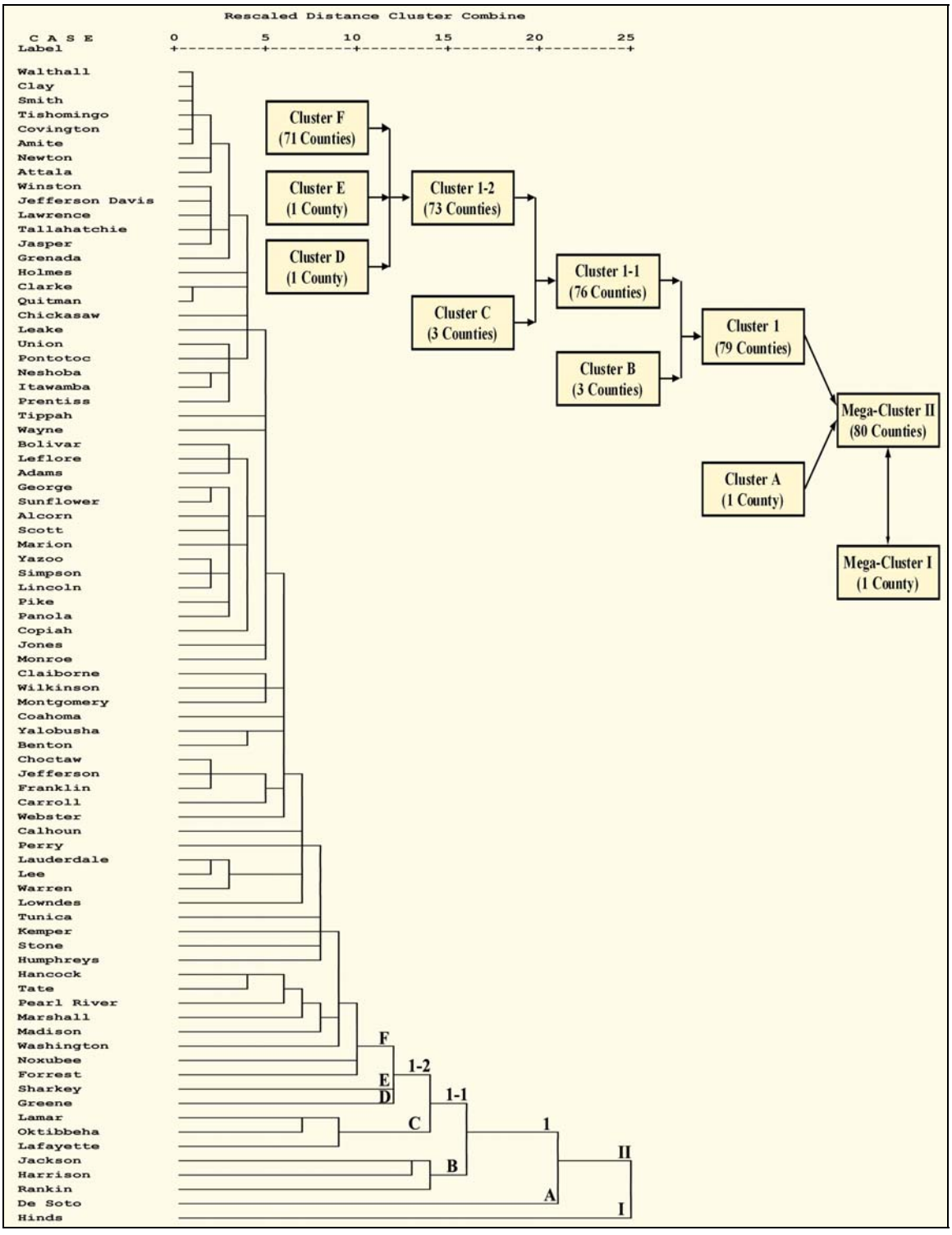


Figure 5.29 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Mississippi, 1995 – 2000

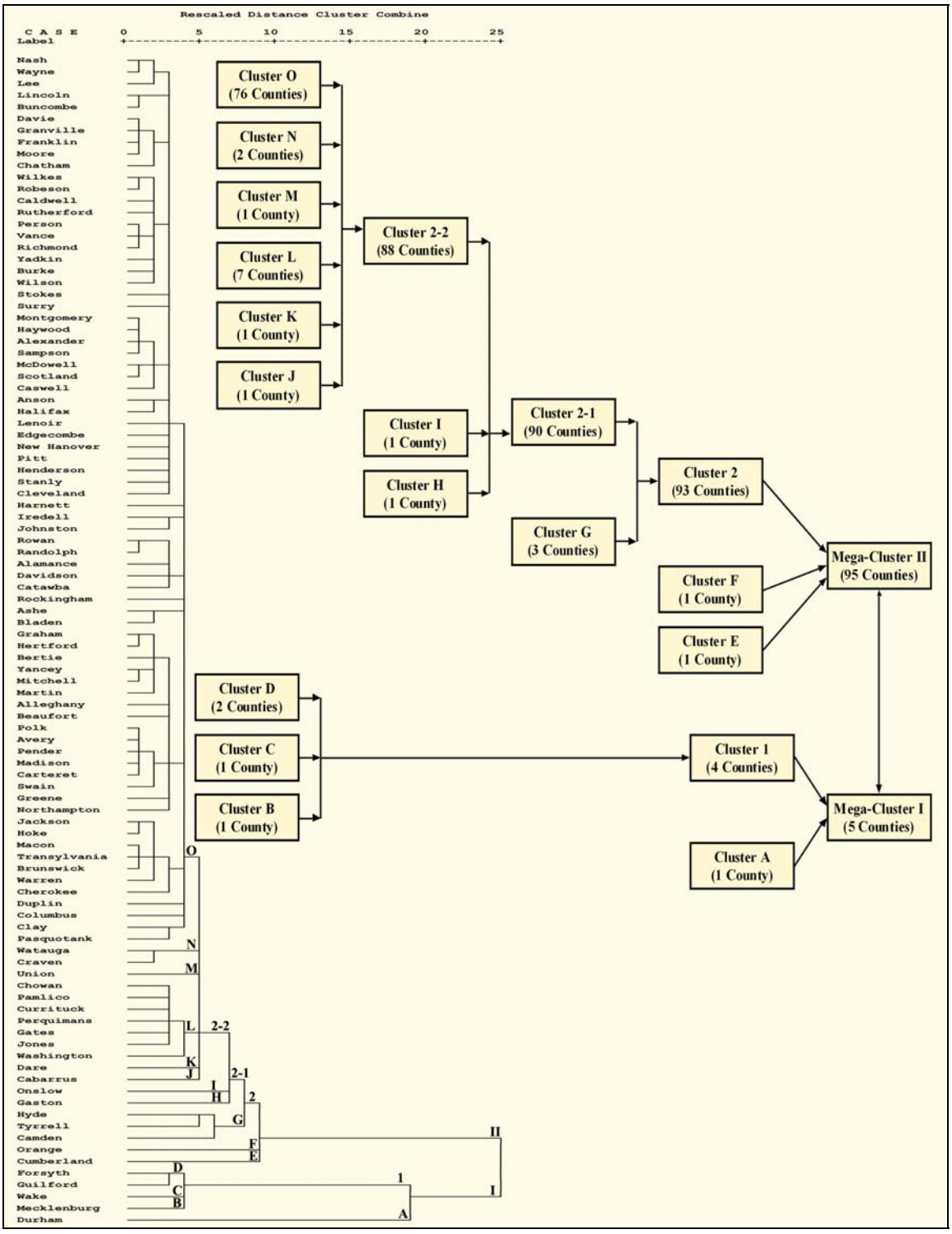


Figure 5.30 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of North Carolina, 1995 – 2000

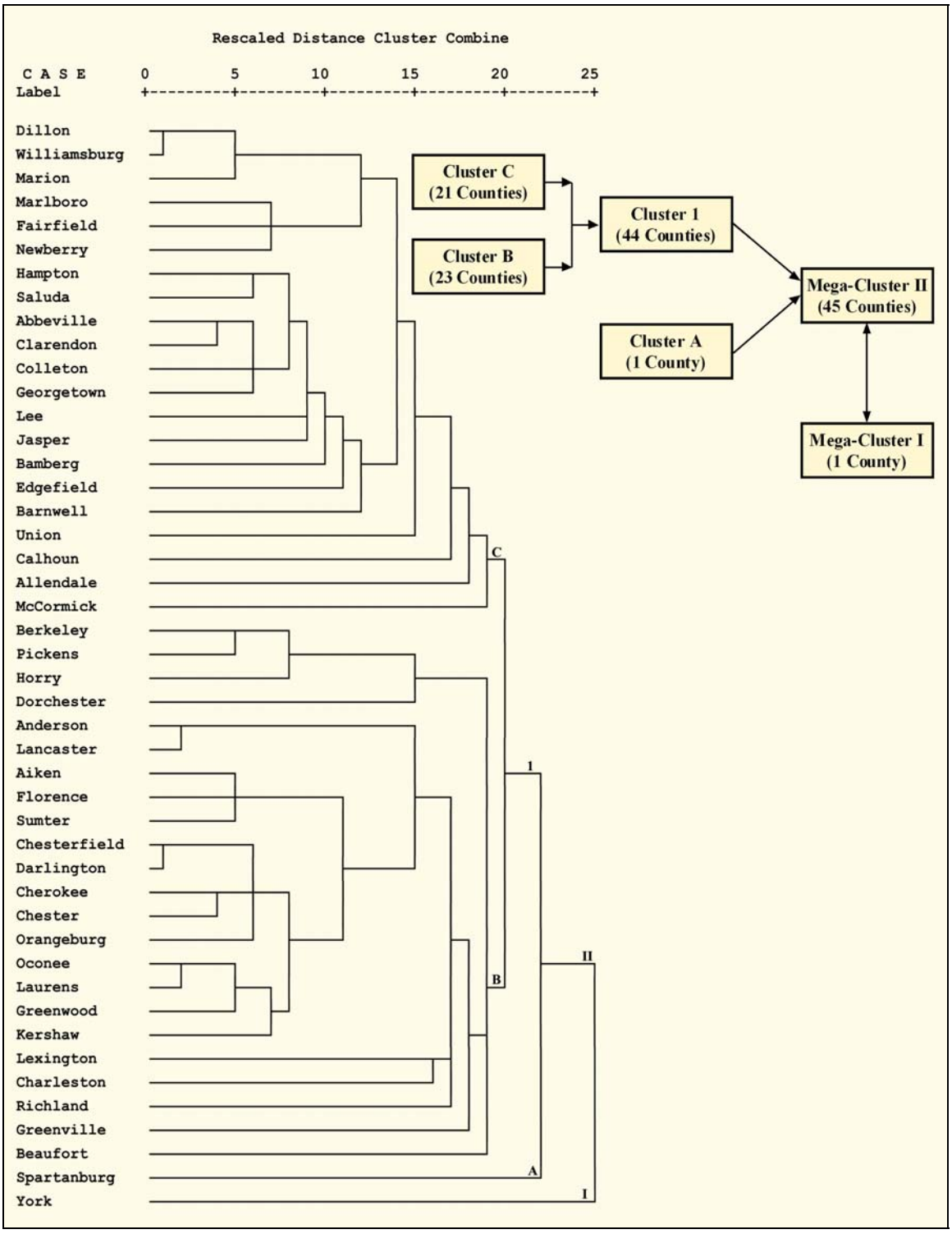


Figure 5.31 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of South Carolina, 1995 – 2000

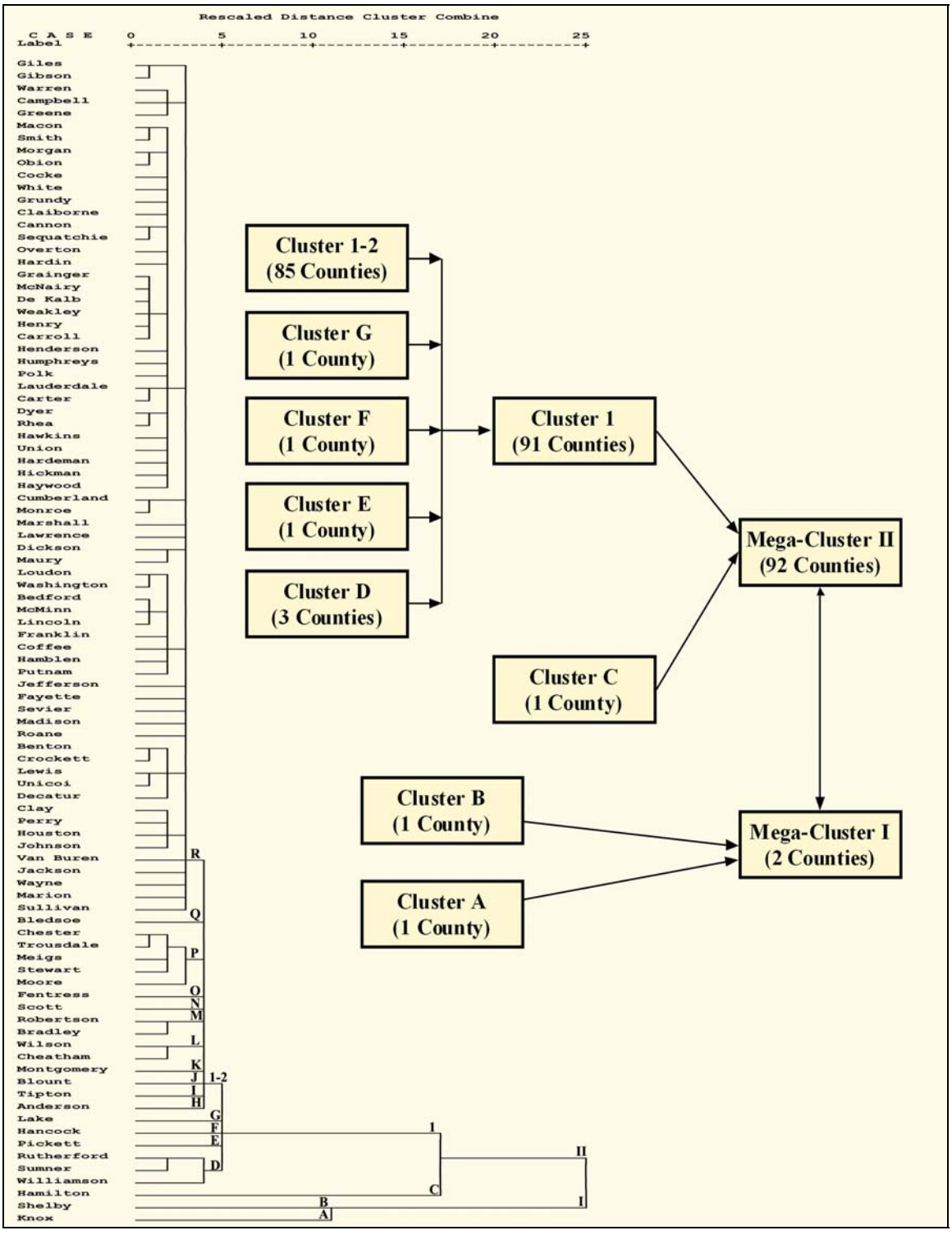


Figure 5.32 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of Tennessee, 1995 – 2000

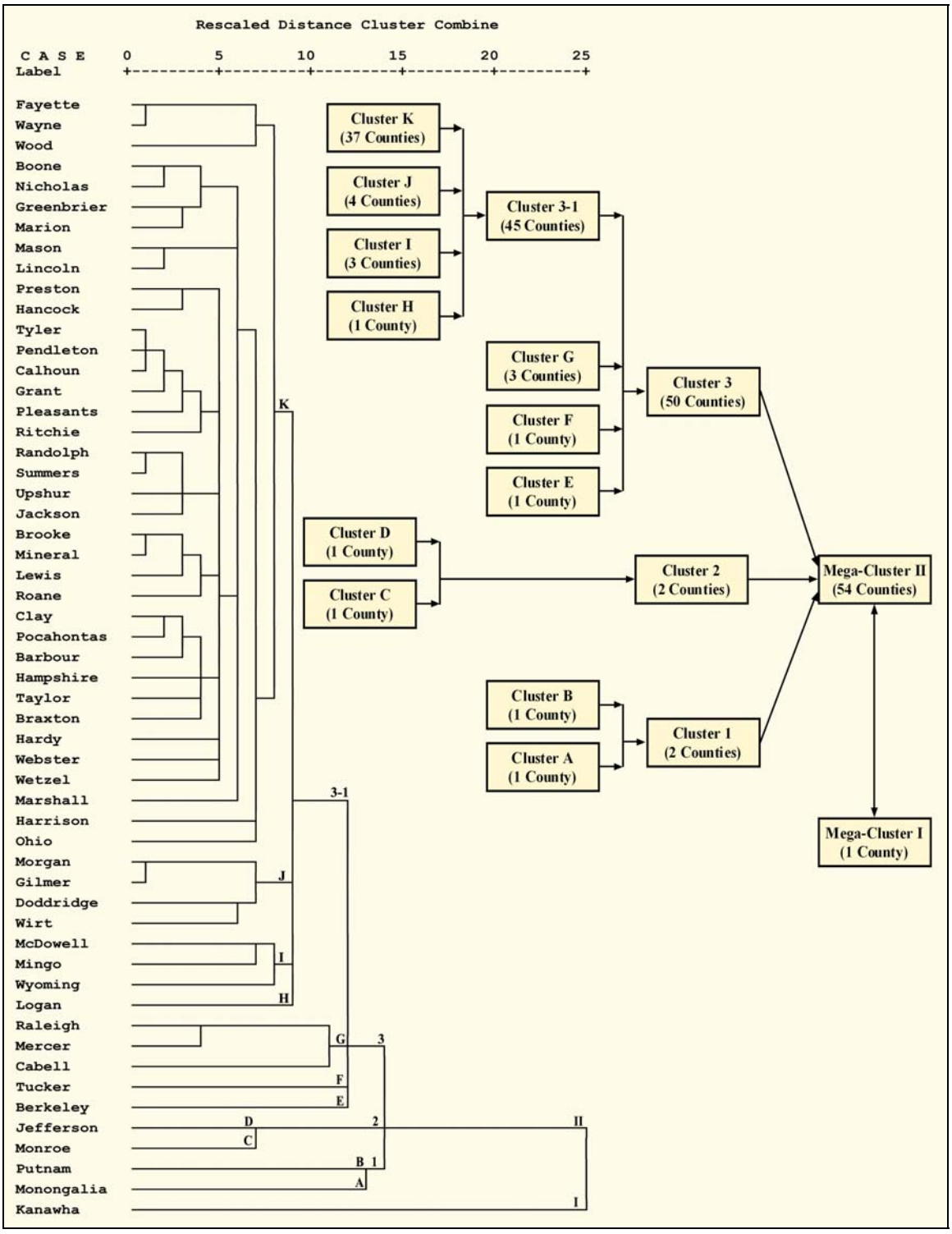


Figure 5.33 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Population Growth of West Virginia, 1995 – 2000

5.1.4 Spatial Autocorrelation Analysis for Population Growth Factor

Figure 5.34 shows a map of the spatial distribution (spatial cluster and spatial outliers) of the population growth factor and the Global Moran I for Alabama. The LISA map and Moran scatterplots are employed to visualize and contrast the distribution of the data and the extent of their local and global spatial autocorrelation. The Moran scatterplot regresses a spatially lagged transformation of population growth factor (y-axis) on the original population growth factor (x-axis). The slope of the scatterplot corresponds to the value for Moran's I, which was 0.4622. The results of the spatial autocorrelation analysis show that the Moran's I has a statistically significant and highly positive spatial autocorrelation in the overall dataset. The positive spatial autocorrelation means that the data is located in the first and third quadrants of the Moran's scatterplot. In other words, the observation's value in relation to its neighbor were high-high (hot spot) and low-low (cold spot). This is shown in the LISA map, which provides the spatial clusters and outliers. There are 10 counties in the high-high location shown in red; these are the hot spots, which mean that there is a statistically significant high population growth characteristic. These ten counties are part of the Dothan, AL MSA, Montgomery, AL MSA, and Columbus, AL-GA MSA, or adjacent to these metropolitan areas.

There are 10 counties in the low-low quadrant (cold spot). These areas are a cold spot, which means they are statistically significant with low population growth characteristics. There are two cluster sets. The first cluster set consists of two counties located in northwest Alabama; these counties are Franklin and Lawrence. Lawrence

County is part of the Huntsville-Decatur, AL MSA. The rest of the cold spot counties are urban 6 & 7 and rural counties of southwest Alabama.

Shelby County and Pike County together constitute a low-high county cluster (spatial outlier); this cluster has a statistically significant low population growth characteristic, but its surrounding counties have relatively high population growth characteristics. The rest of the counties do not have statistically significant spatial clusters or outliers.

The rest of the states provided follow the same pattern of analysis as provided for Alabama.

Summary: Based on the results of the spatial autocorrelation analysis for the population growth variables, the following conclusions are made.

1) The range of the Global Moran's I is 0.3374 (West Virginia) to 0.7626 (Kentucky) with a mean of 0.5426. There is a positive spatial autocorrelation for each state. This means that the observation's values in relation to its neighbor are high-high and low-low; in other words, there are clusters of hot spots and cold spots, where hot spots represent faster population growth and cold spots represent a decline in population growth.
2) Most of the high-high population growth cluster areas are located next to large cities with population of more than 100,000. A majority of the low-low population growth clusters are located in urban 6 & 7 counties. Although there are some similarities between the results of the spatial autocorrelation analysis for population growth and the results of the spatial autocorrelation of economic growth, the results also suggest there are some significant differences in the

spatial clusters and outliers. This is probably due to different combinations of racial characteristics, median age, and natural increase, each of which strongly influences the population growth factor.

3) The university influence does not appear to have much of an impact on the population growth, based on the description map comparison. Interstate highways, however, do have some positive influence for the high-high population growth clusters. The overall map for the Southeast is shown in Chapter VI.

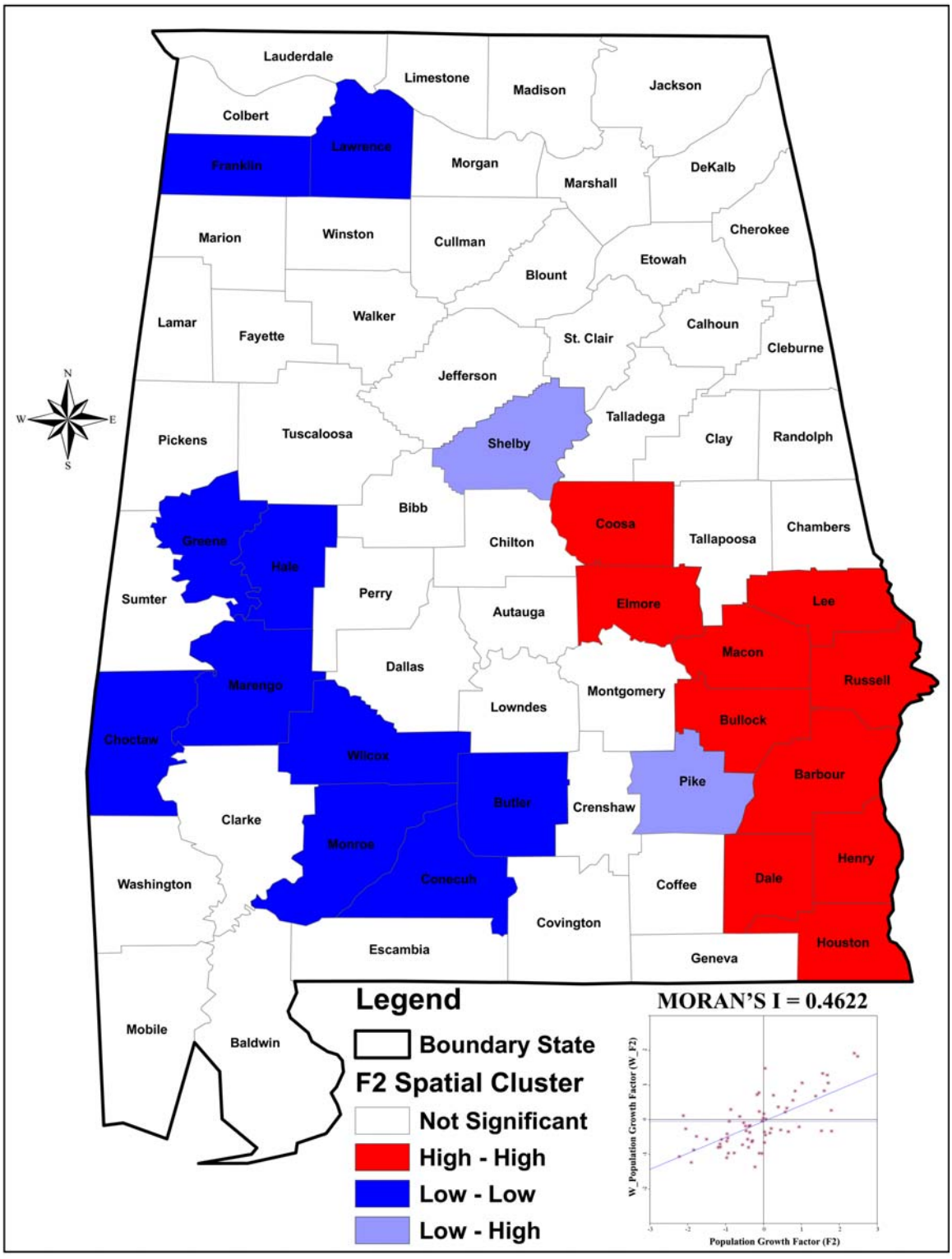


Figure 5.34 Spatial Autocorrelation Results for the Population Growth Factor of Alabama, 1995 – 2000

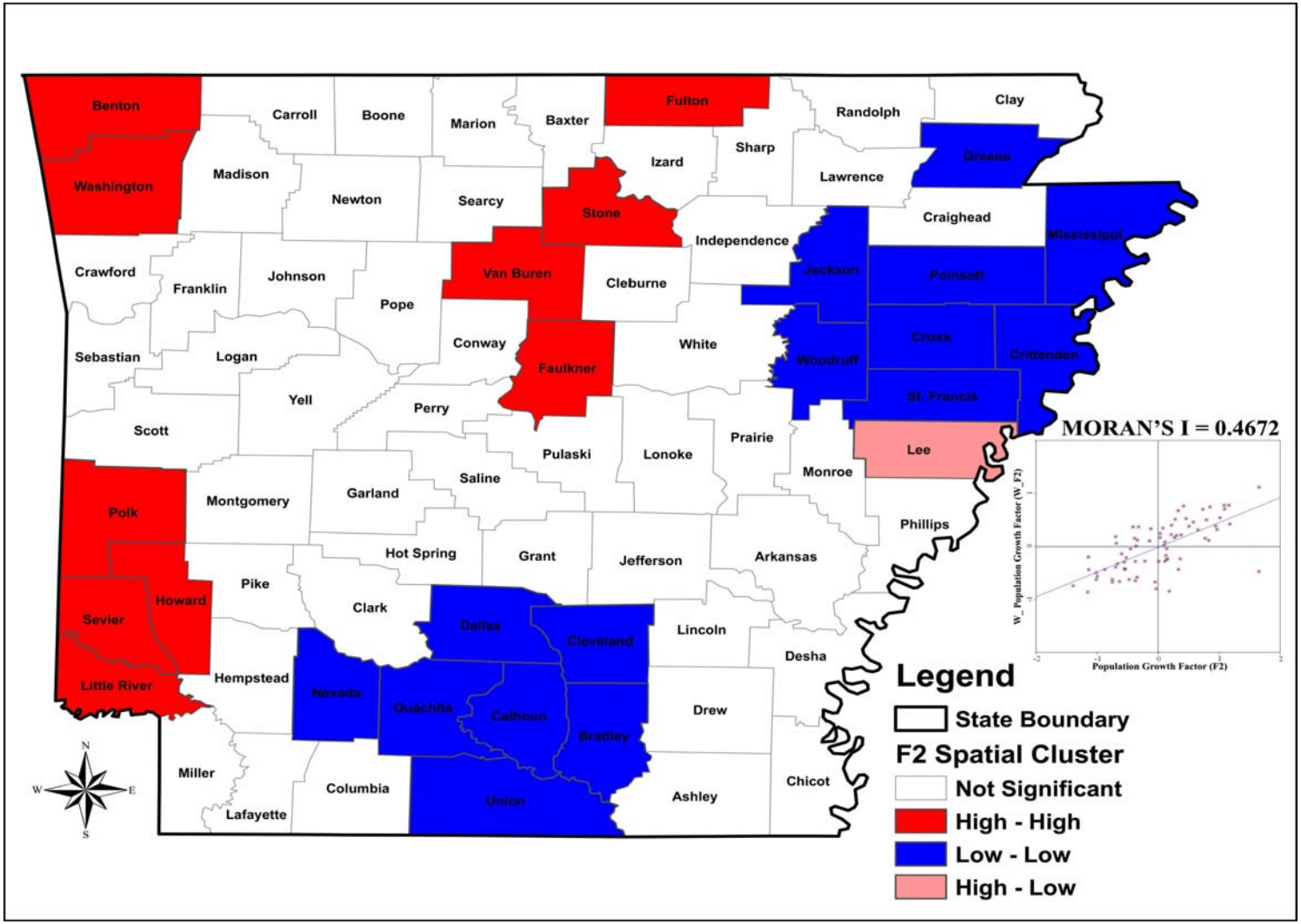


Figure 5.35 Spatial Autocorrelation Results for the Population Growth Factor of Arkansas, 1995 – 2000

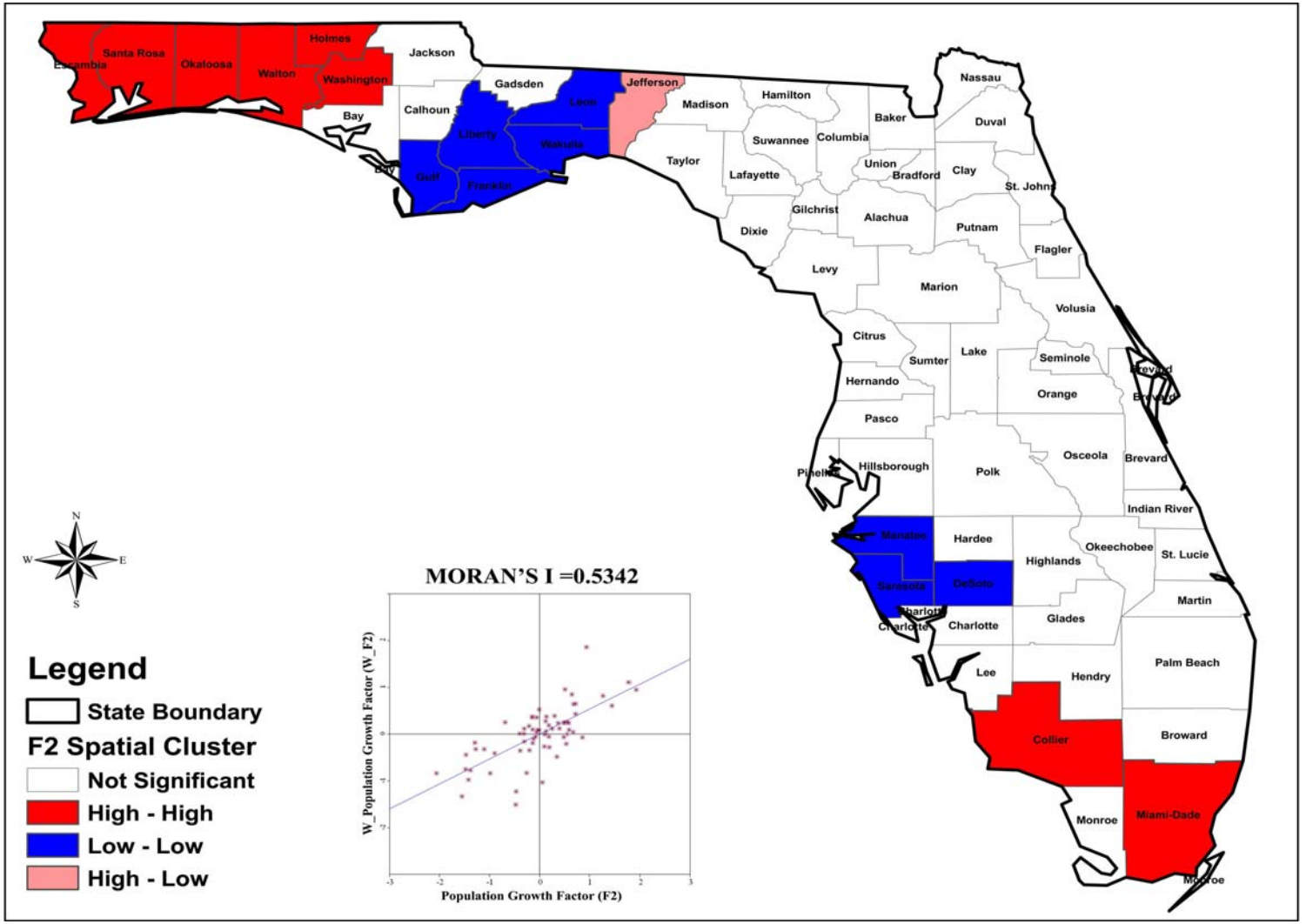


Figure 5.36 Spatial Autocorrelation Results for the Population Growth Factor of Florida, 1995 – 2000

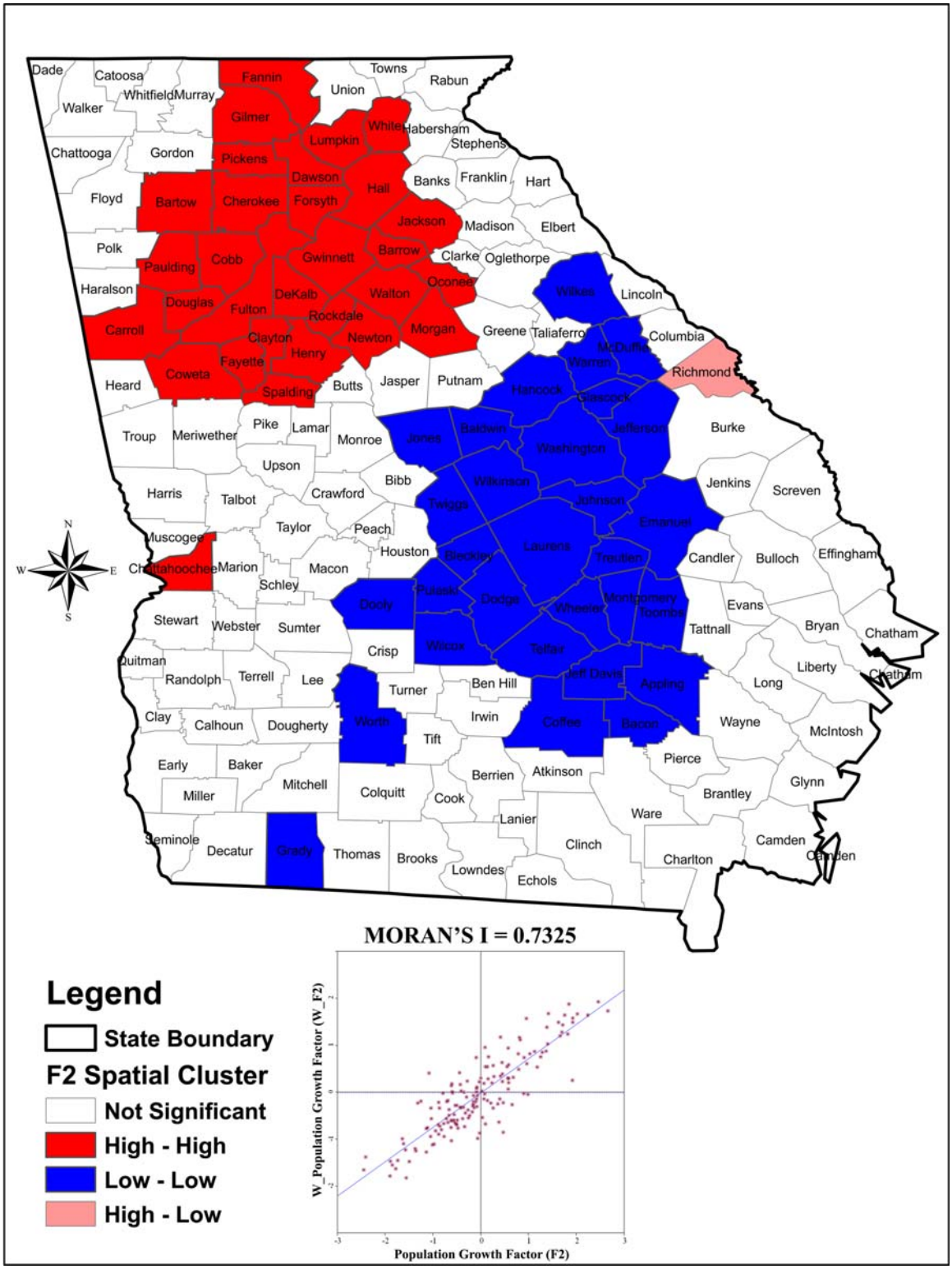


Figure 5.37 Spatial Autocorrelation Results for the Population Growth Factor of Georgia, 1995 – 2000

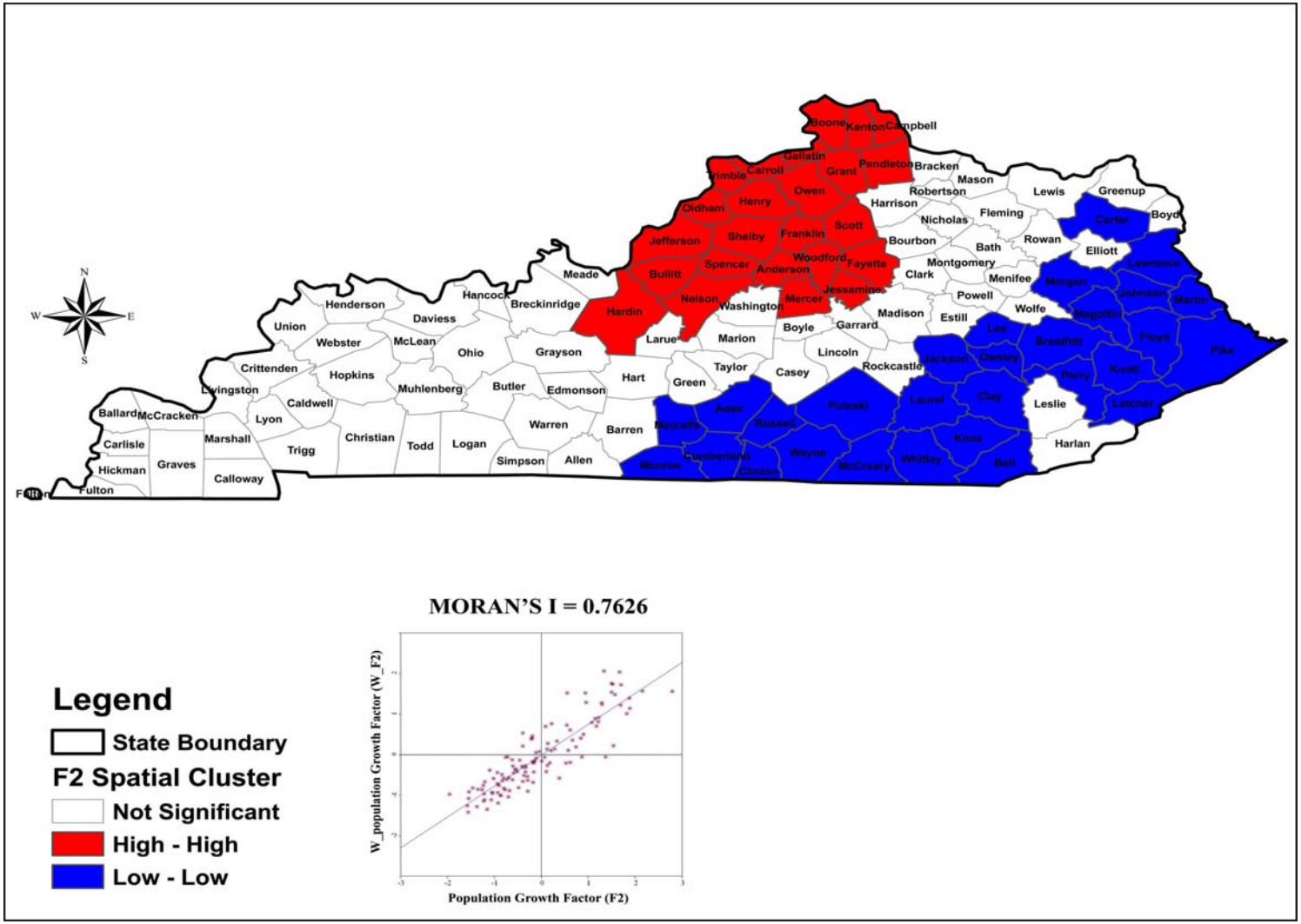


Figure 5.38 Spatial Autocorrelation Results for the Population Growth Factor of Kentucky, 1995 – 2000

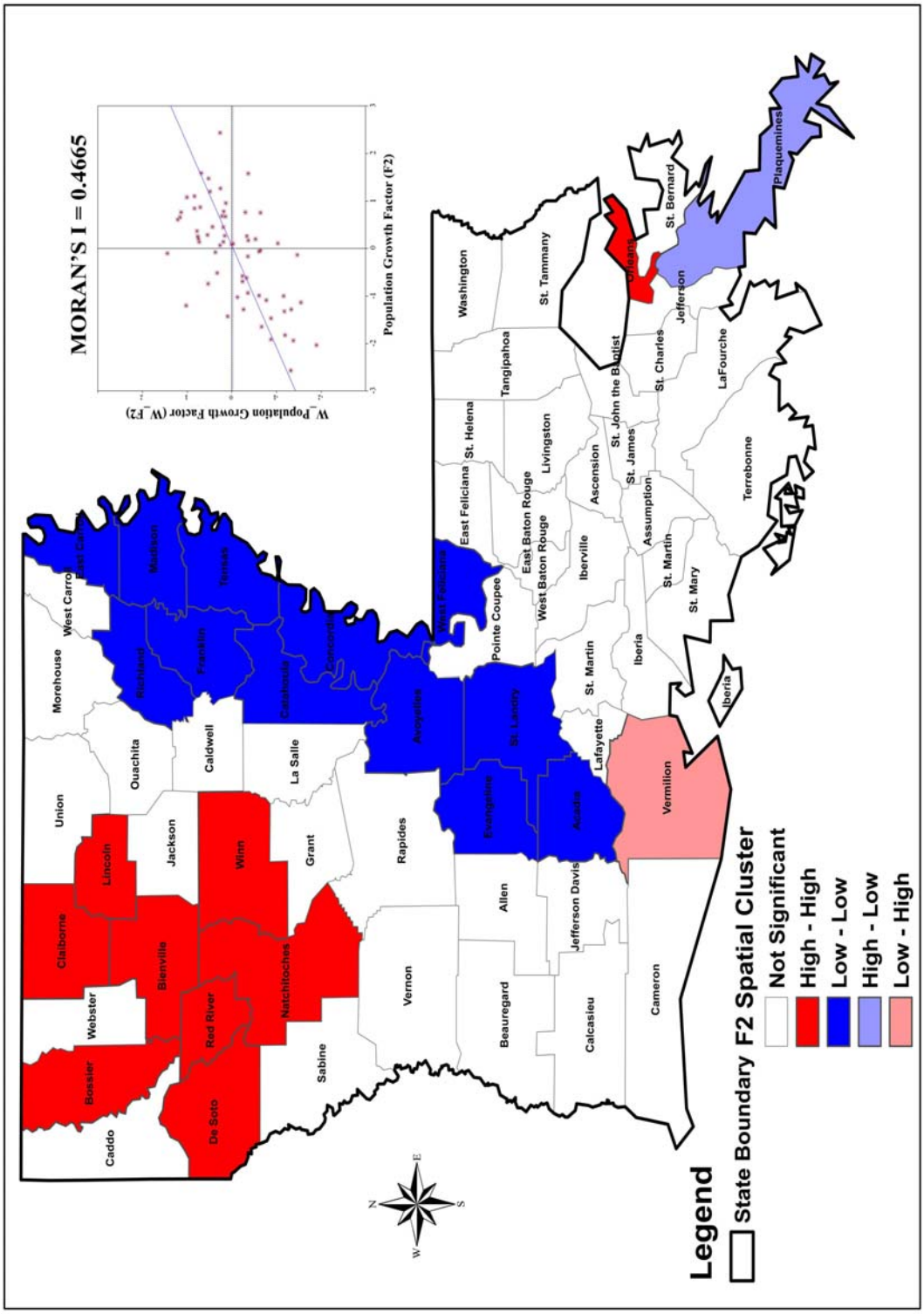


Figure 5.39 Spatial Autocorrelation Results for the Population Growth Factor of Louisiana, 1995 – 2000

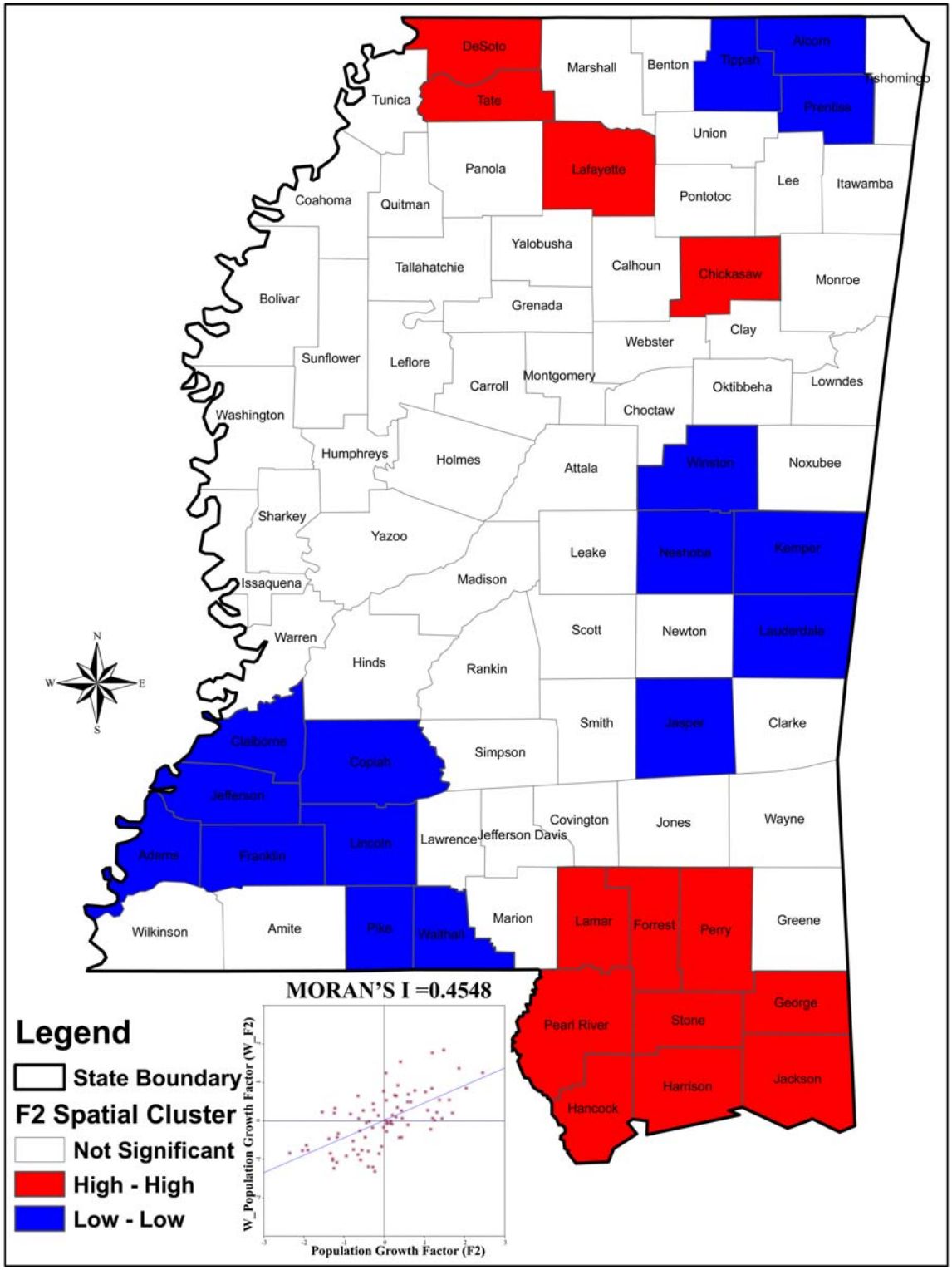


Figure 5.40 Spatial Autocorrelation Results for the Population Growth Factor of Mississippi, 1995 – 2000

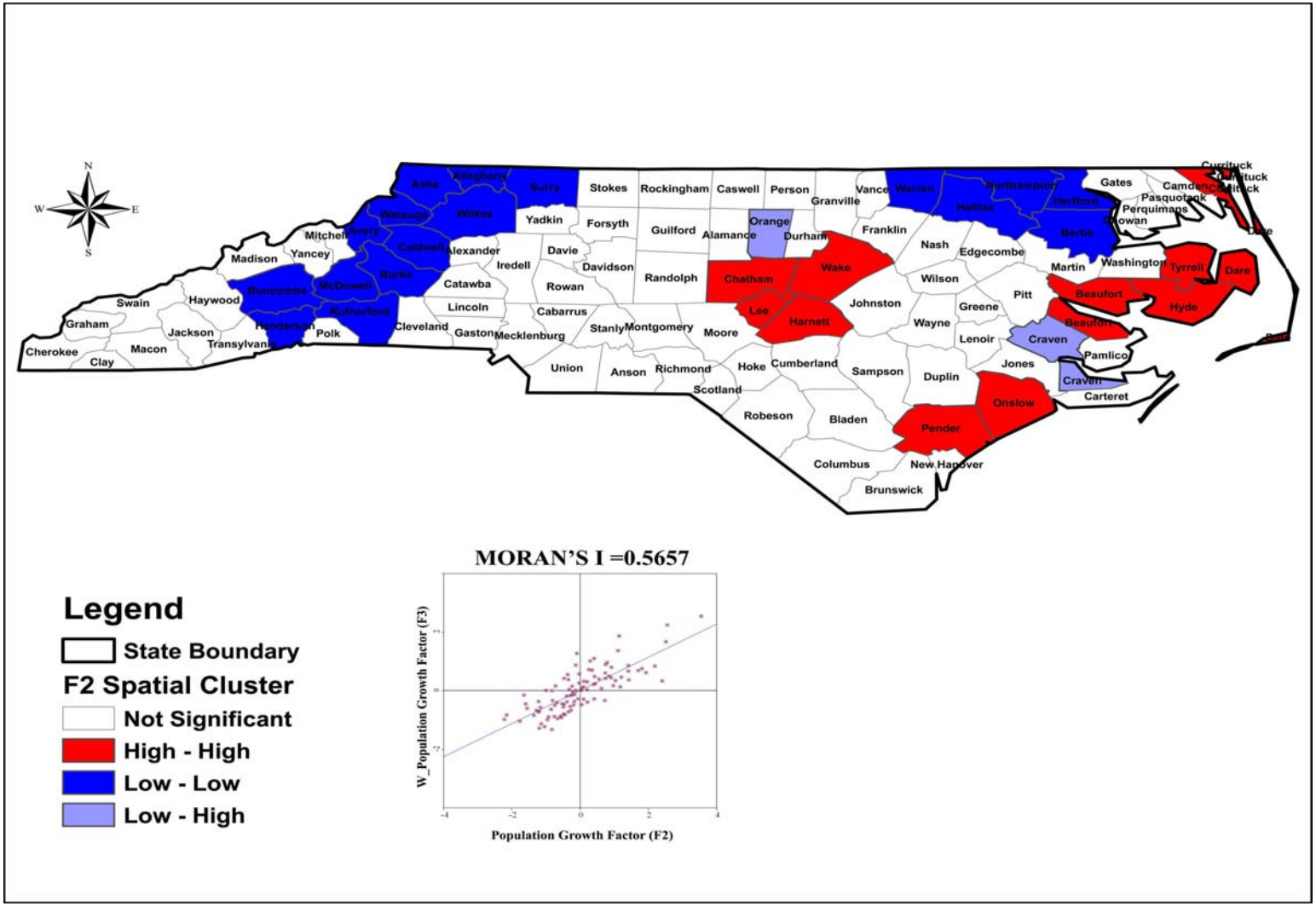


Figure 5.41 Spatial Autocorrelation Results for the Population Growth Factor of North Carolina, 1995 – 2000

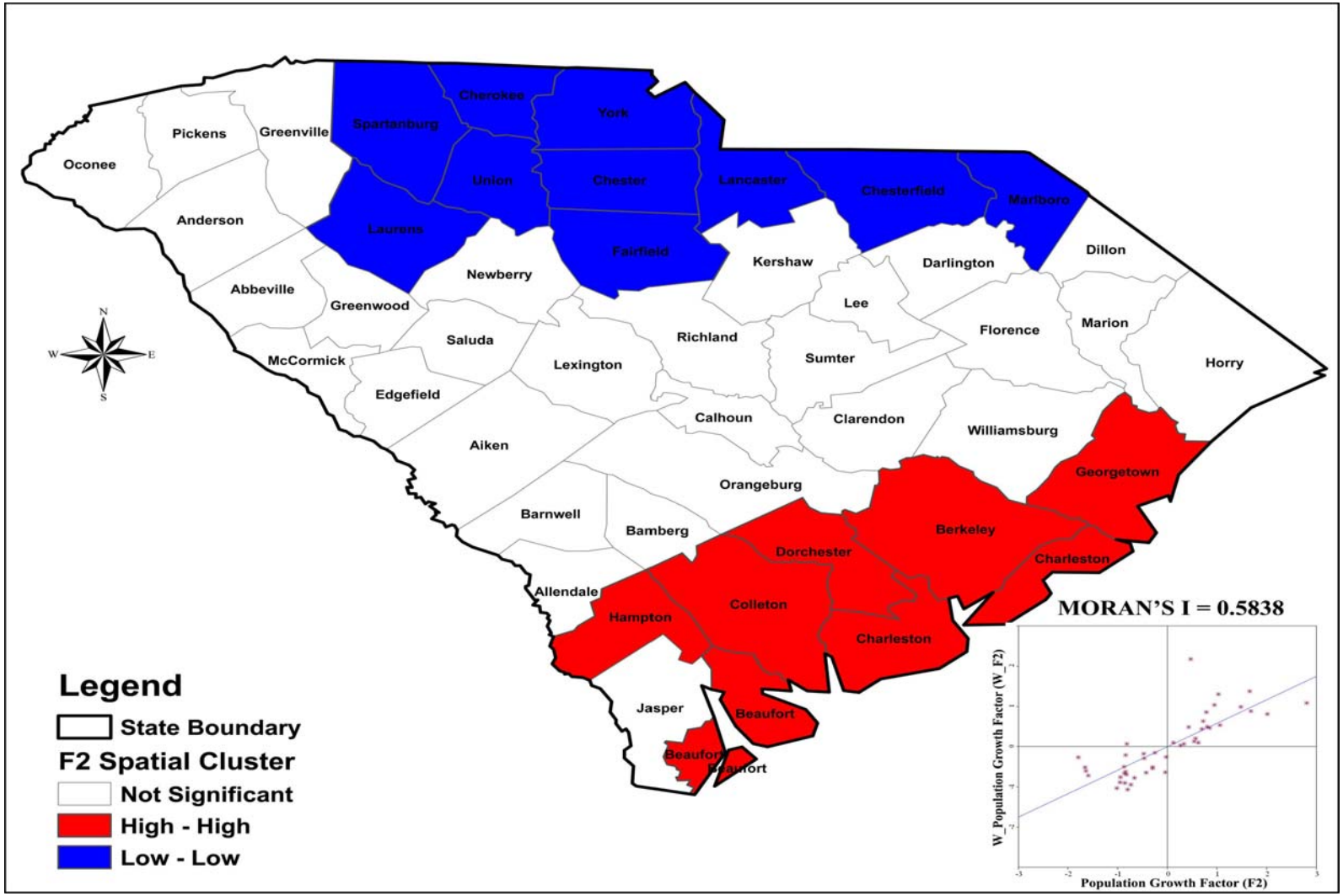


Figure 5.42 Spatial Autocorrelation Results for the Population Growth Factor of South Carolina, 1995 – 2000

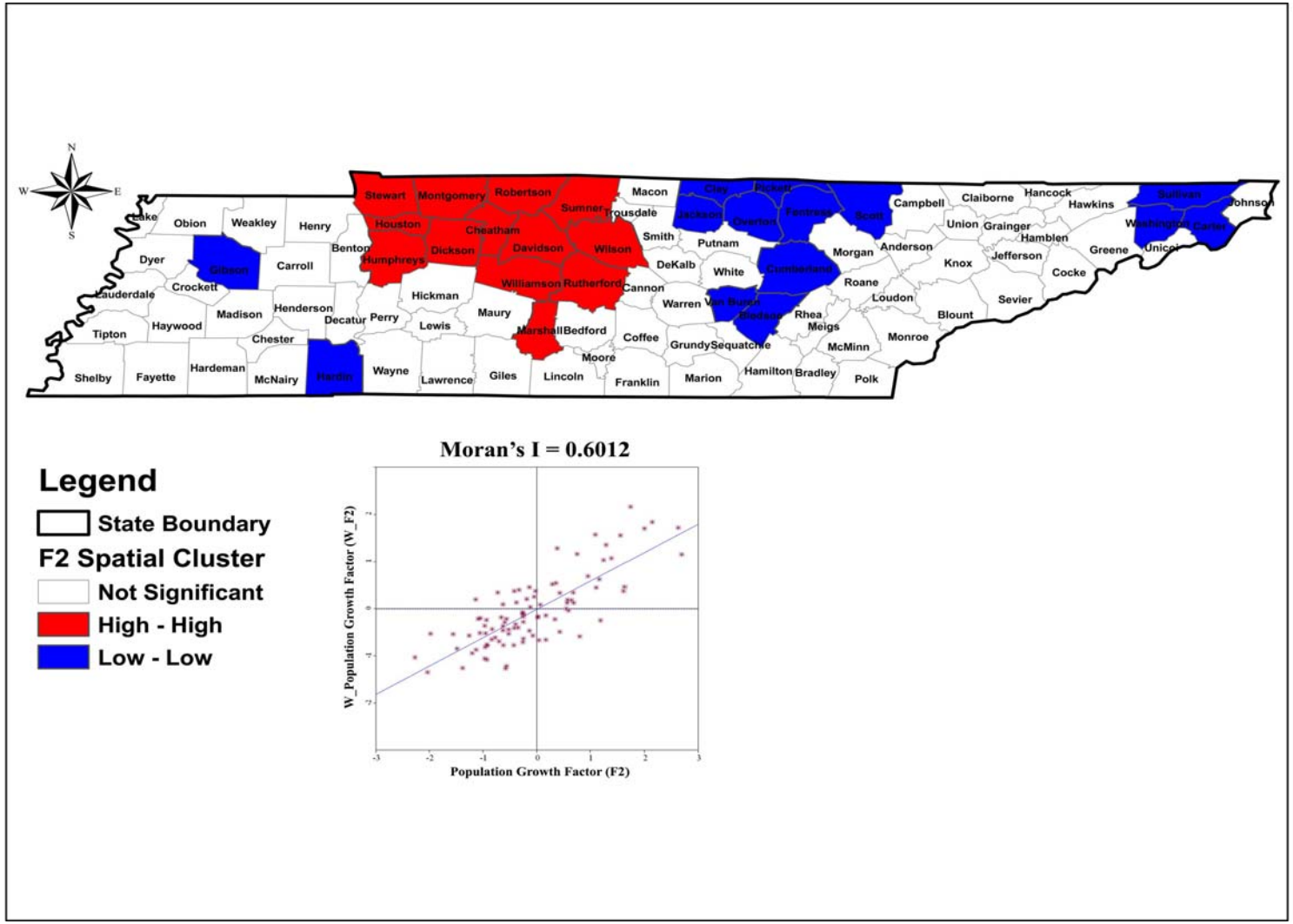


Figure 5.43 Spatial Autocorrelation Results for the Population Growth Factor of Tennessee, 1995 – 2000

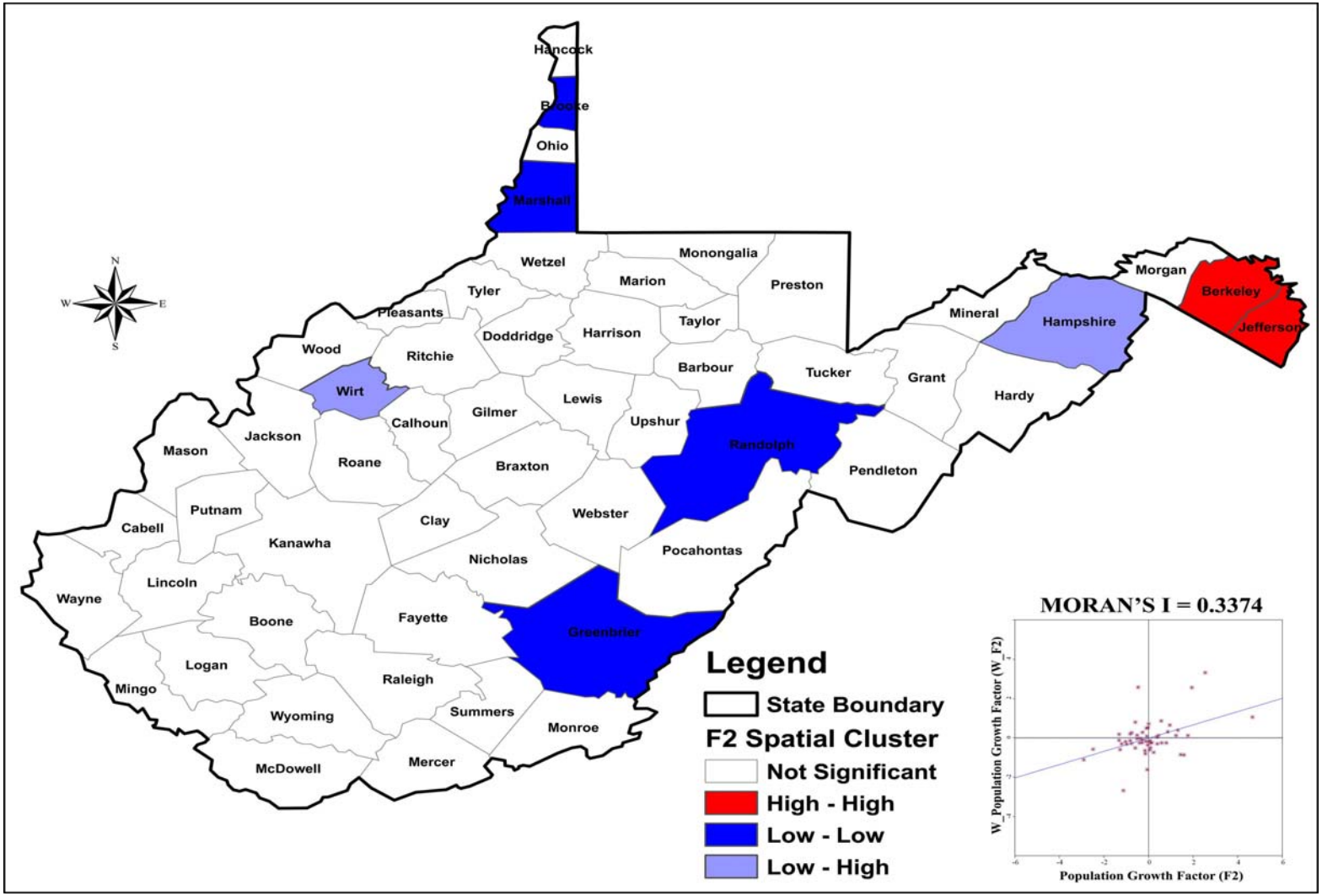


Figure 5.44 Spatial Autocorrelation Results for the Population Growth Factor of West Virginia, 1995 – 2000

5.1.5 Hierarchical Cluster Analysis for 2000 Social Development Factor

Results (dendrogram and compressed figure) for the hierarchical cluster analysis for the 2000 social development variables (*ECON_00*, *EDUC_00*, and *HOUS_00*) with consideration of the large cities' gravity (*LNGRAV*) for each state are illustrated in Figure 5.46 through Figure 5.55. The results for the hierarchical cluster analysis for 2000 social development of Alabama are explained. All of the other states follow the same pattern of analysis as provided in the following illustration.

Alabama: Figure 5.46 illustrates the dendrogram for the 2000 social development variables hierarchical cluster analysis of the state of Alabama. From Figure 5.46, the highest rescaled distance counties build up single clusters, such as Cluster A (Jefferson County in Birmingham-Hoover-Cullman, AL MSA) and Cluster B (Madison County in Huntsville-Decatur, AL MSA). Mobile County in Mobile-Daphne-Fairhope, AL MSA and Montgomery County in Montgomery, AL MSA build up compact Cluster C. Cluster B and compact Cluster C build up a loose Cluster 1. A loose Cluster 1 and Cluster A build up Mega Cluster I. Counties in Mega Cluster I have high or strong 2000 social development characteristics as is the case for the hierarchical cluster analysis for economic growth variables.

Shelby County in Birmingham-Hoover-Cullman MSA is a single Cluster D. Cluster E (64.29% - counties in MSA, 21.43% - Urban 4 &5 counties, and 14.29% - Urban 6 & 7 counties), Cluster F (60.00% - counties in MSA and 40.00% - Urban 6 & 7 counties, and rural counties), Cluster G (Green County – rural county), Cluster H (one Urban 4 &5 county and one Urban 6 & 7 county), and Cluster I (10.00% - counties in MSA, 5.00% - Urban 4 &5 counties, 67.50% - Urban 6 & 7 counties, and 17.50% - rural

counties) built up a loose Cluster 1. A loose Cluster 1 and Cluster D build up Mega Cluster II. Cluster I had the smallest rescaled distance. Counties in the Cluster I has low and declining social development characteristics.

Summary: Based on the results of the hierarchical cluster analysis for the 2000 social development variables, the following conclusions are made:

1) The clusters that have the highest rescaled distance (or the most dissimilar 2000 social development characteristics), when compared to the rest of the counties, are the fastest growing counties in the MSA. Most of these clusters are single county clusters or compact clusters of one or two counties.
2) Results of the hierarchical cluster analysis suggest that the economic growth and the population growth characteristics have strong correlations with social development characteristics.
3) The majority of counties of the clusters that have the lower rescaled distances are counties that are located in urban 6 & 7 and rural counties which are remote from the MSA. They are also more likely to have lower 2000 social development characteristics/rates.

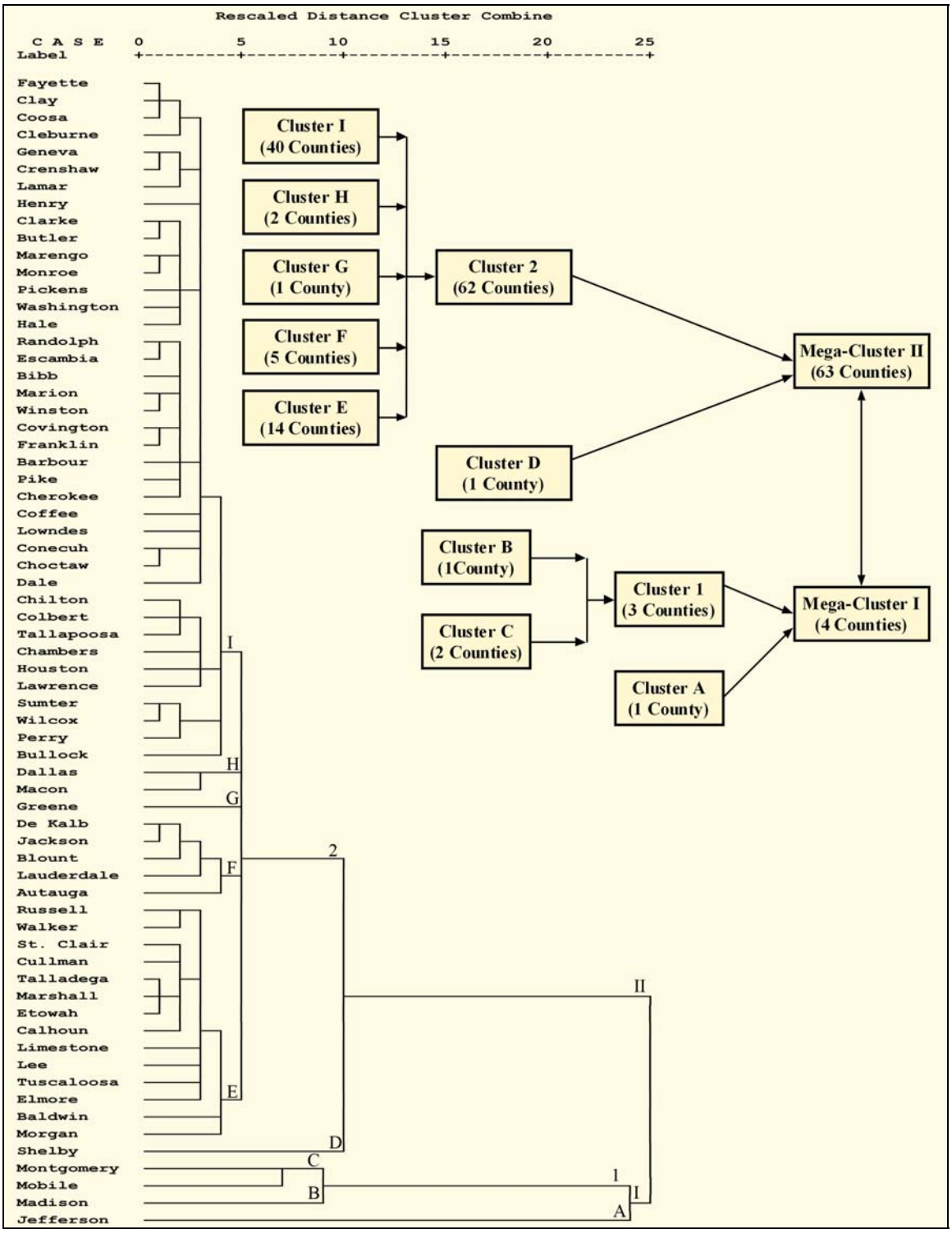


Figure 5.45 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Alabama, 2000

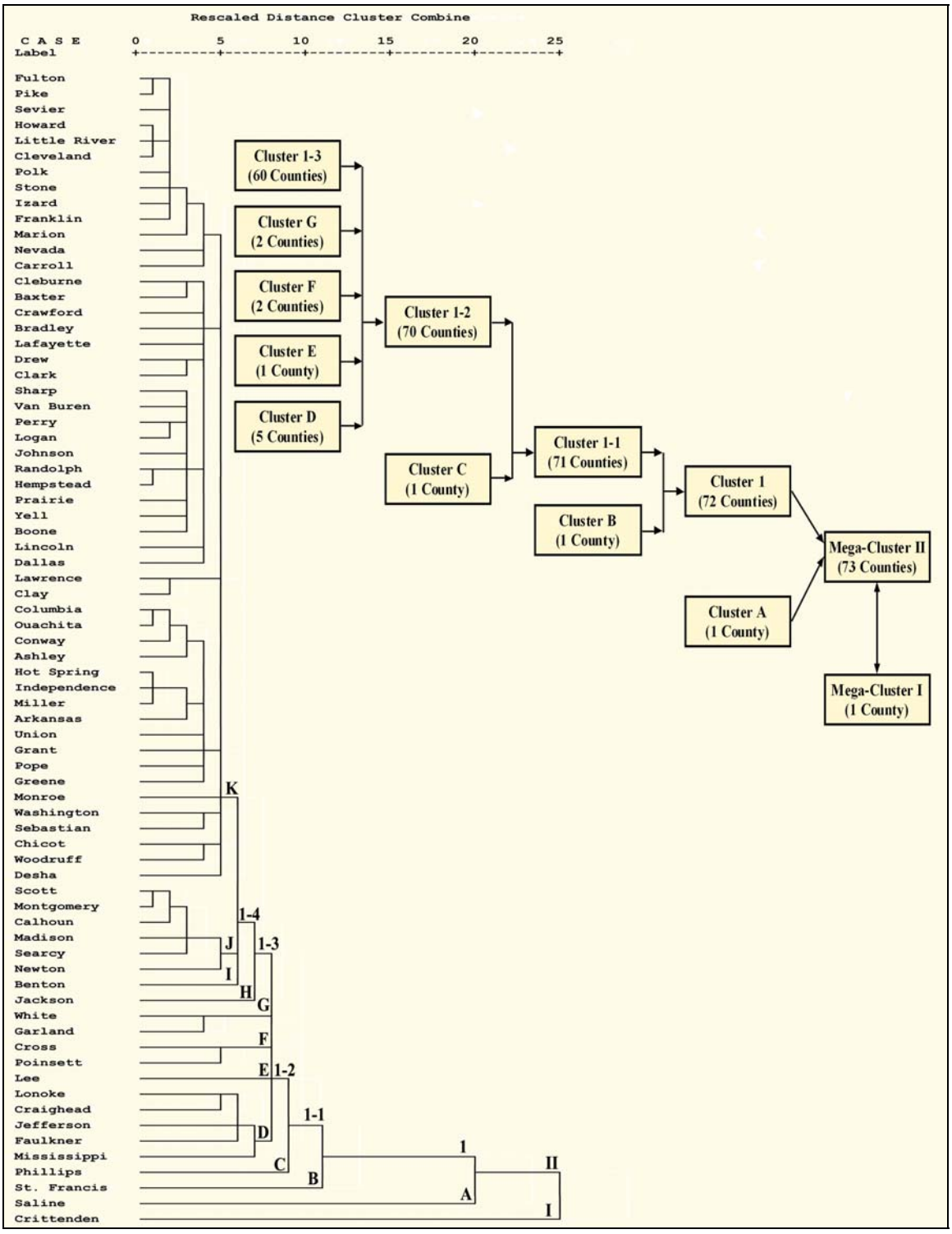


Figure 5.46 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Arkansas, 2000

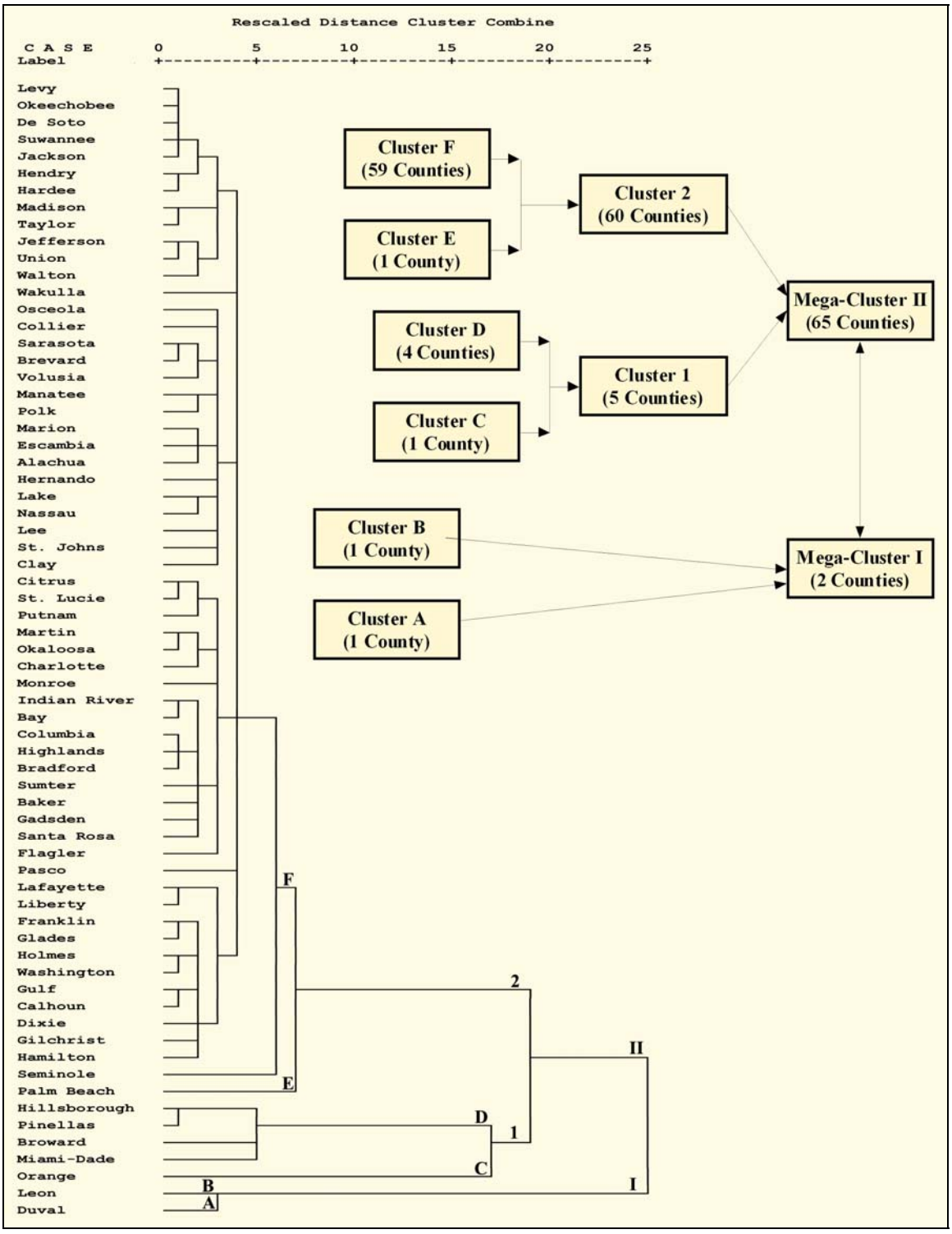


Figure 5.47 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Florida, 2000

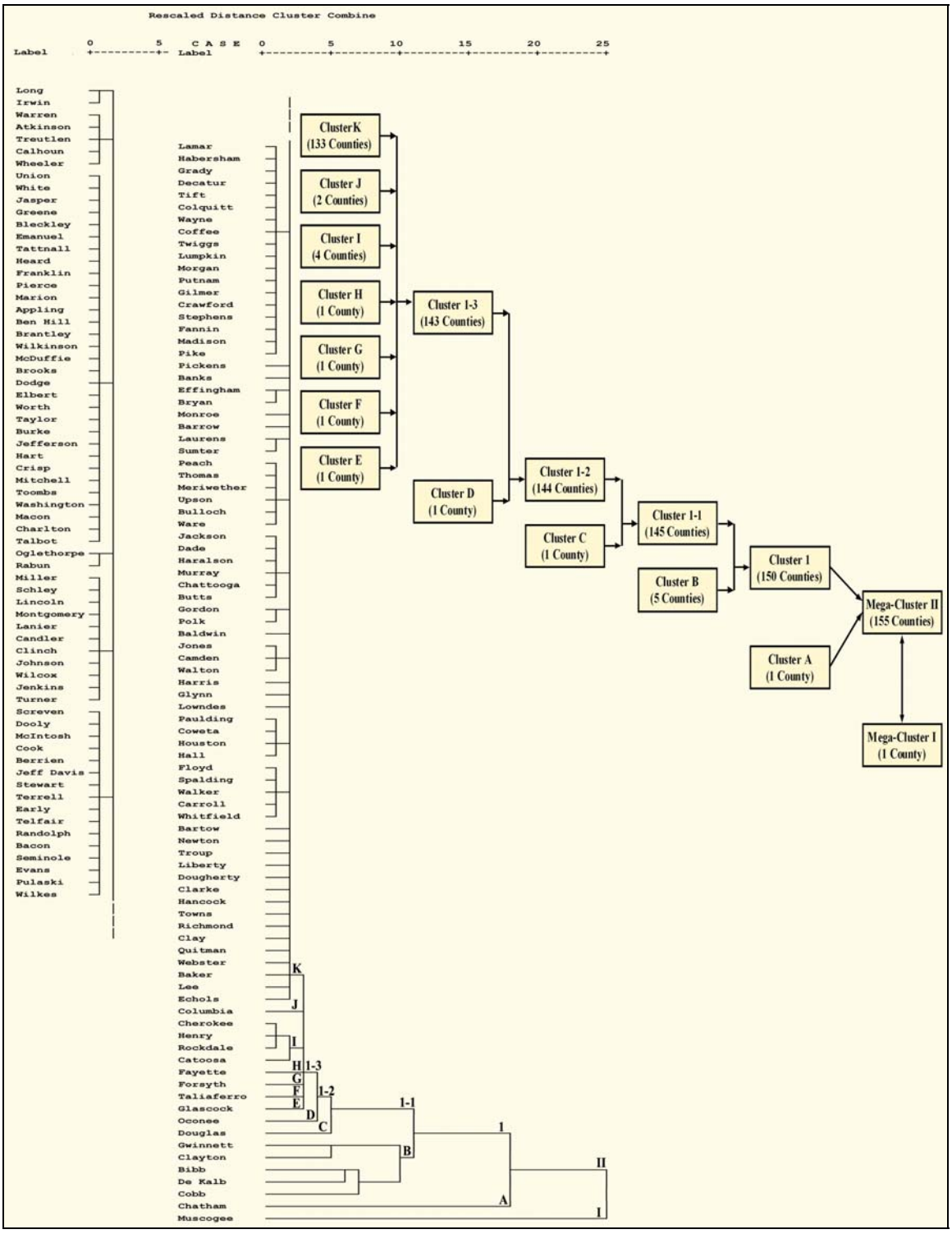


Figure 5.48 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Georgia, 2000

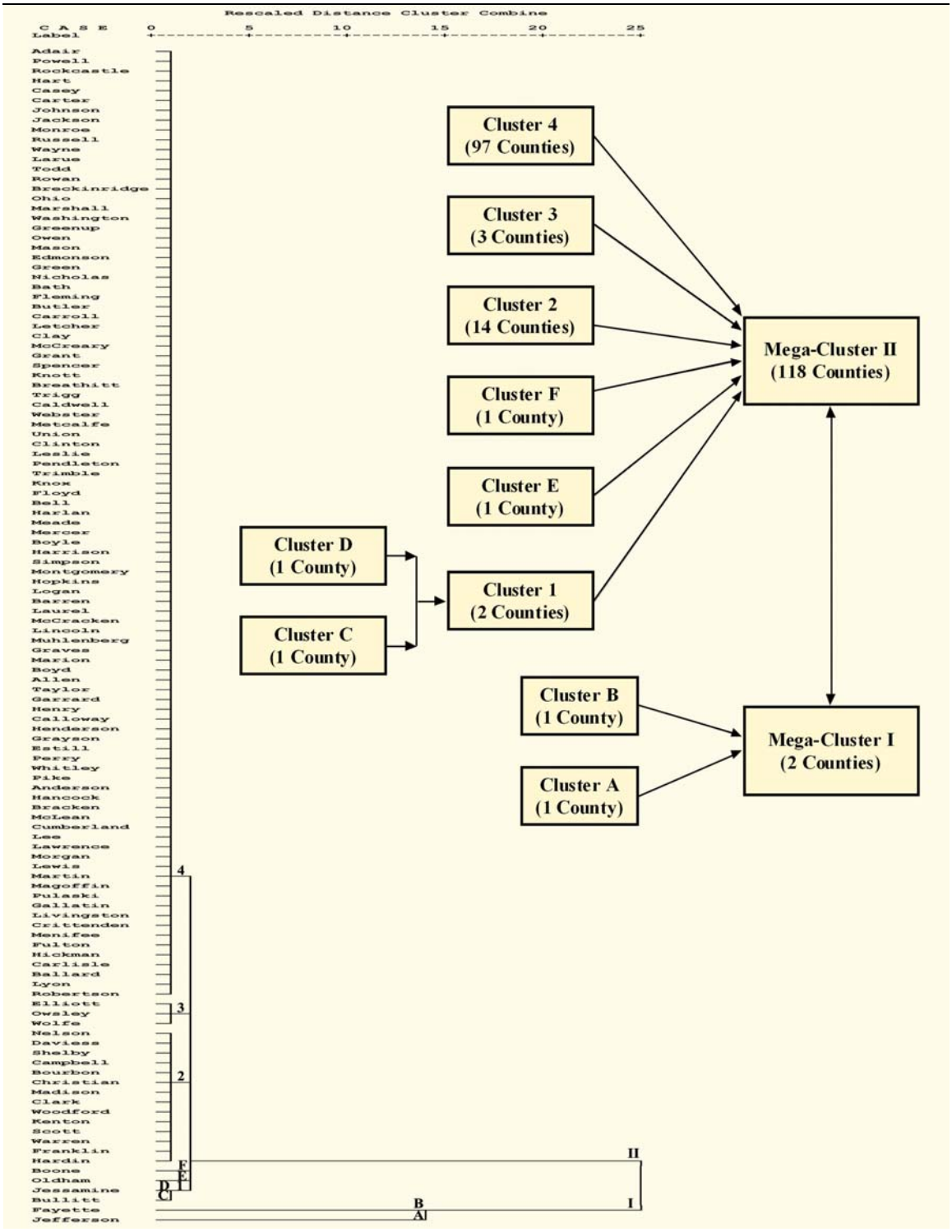


Figure 5.49 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Kentucky, 2000

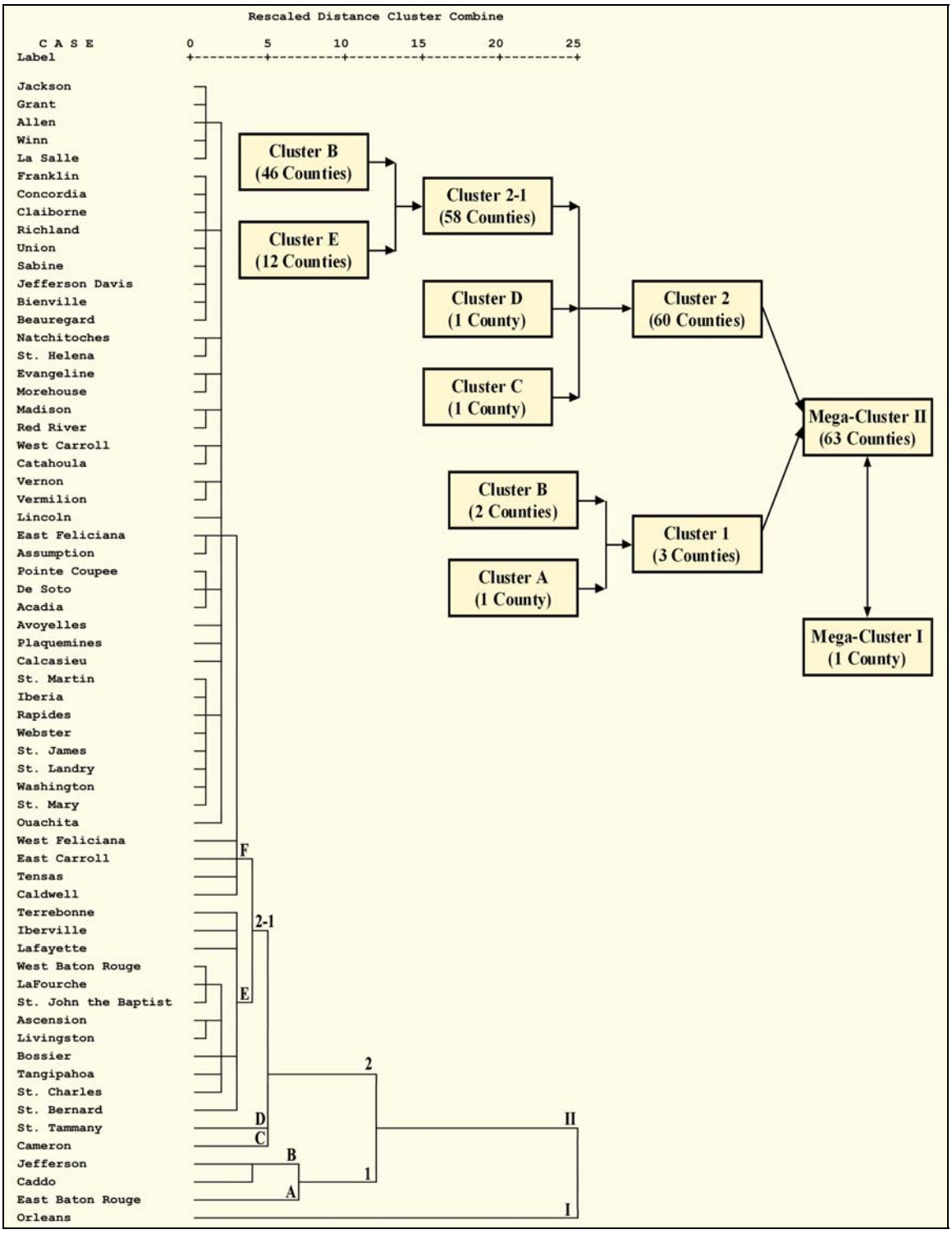


Figure 5.50 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Louisiana, 2000

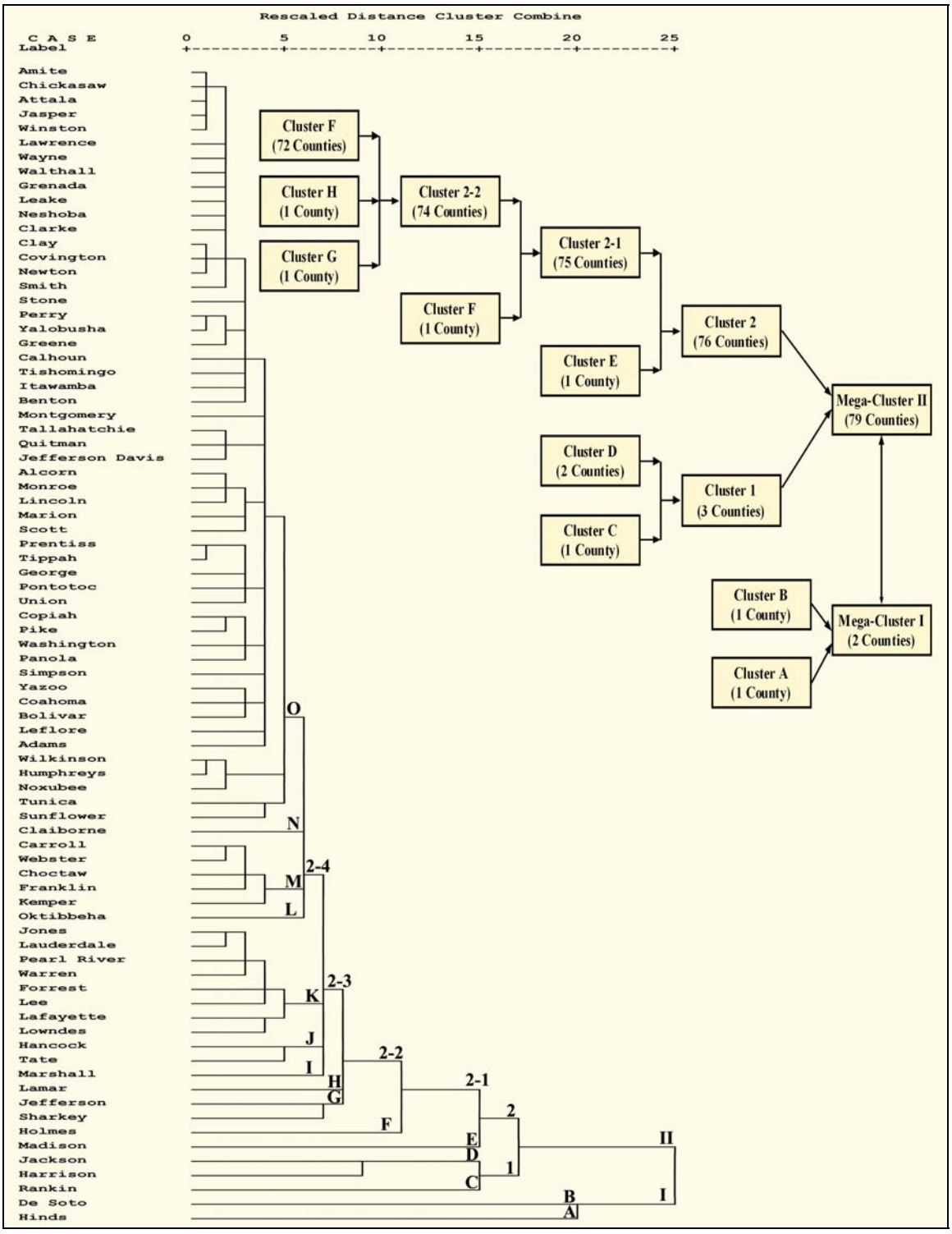


Figure 5.51 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Mississippi, 2000

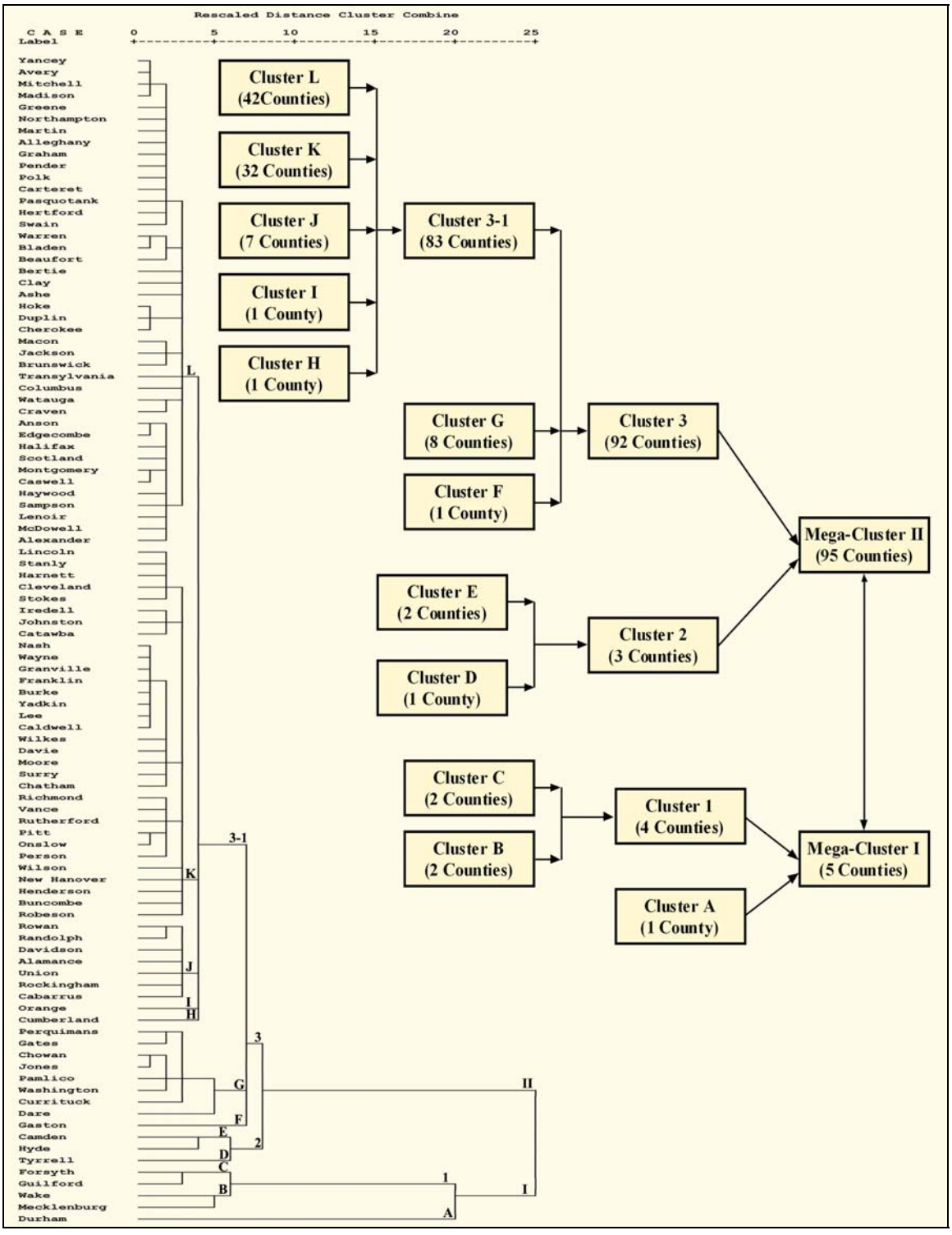


Figure 5.52 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of North Carolina, 2000

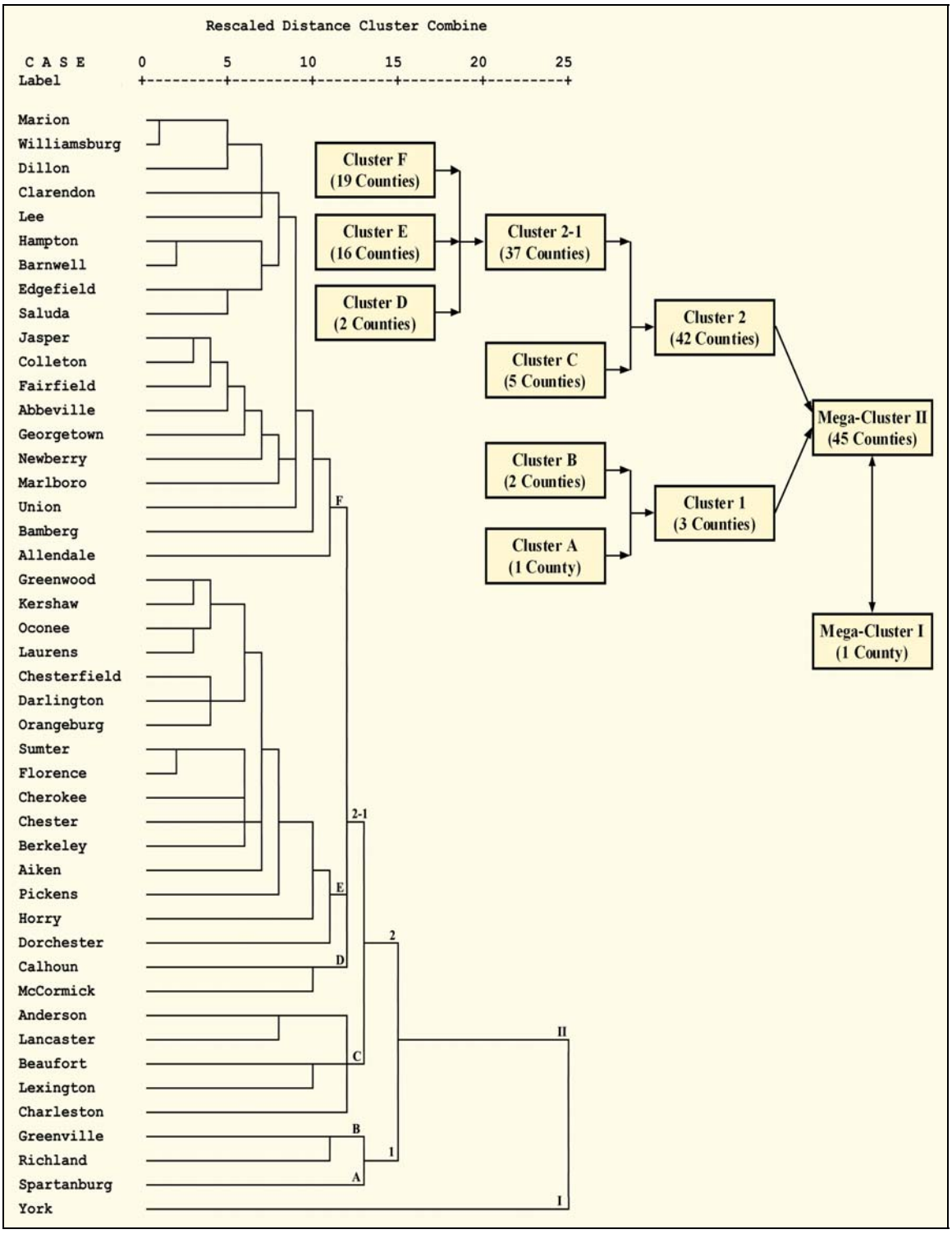


Figure 5.53 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of South Carolina, 2000

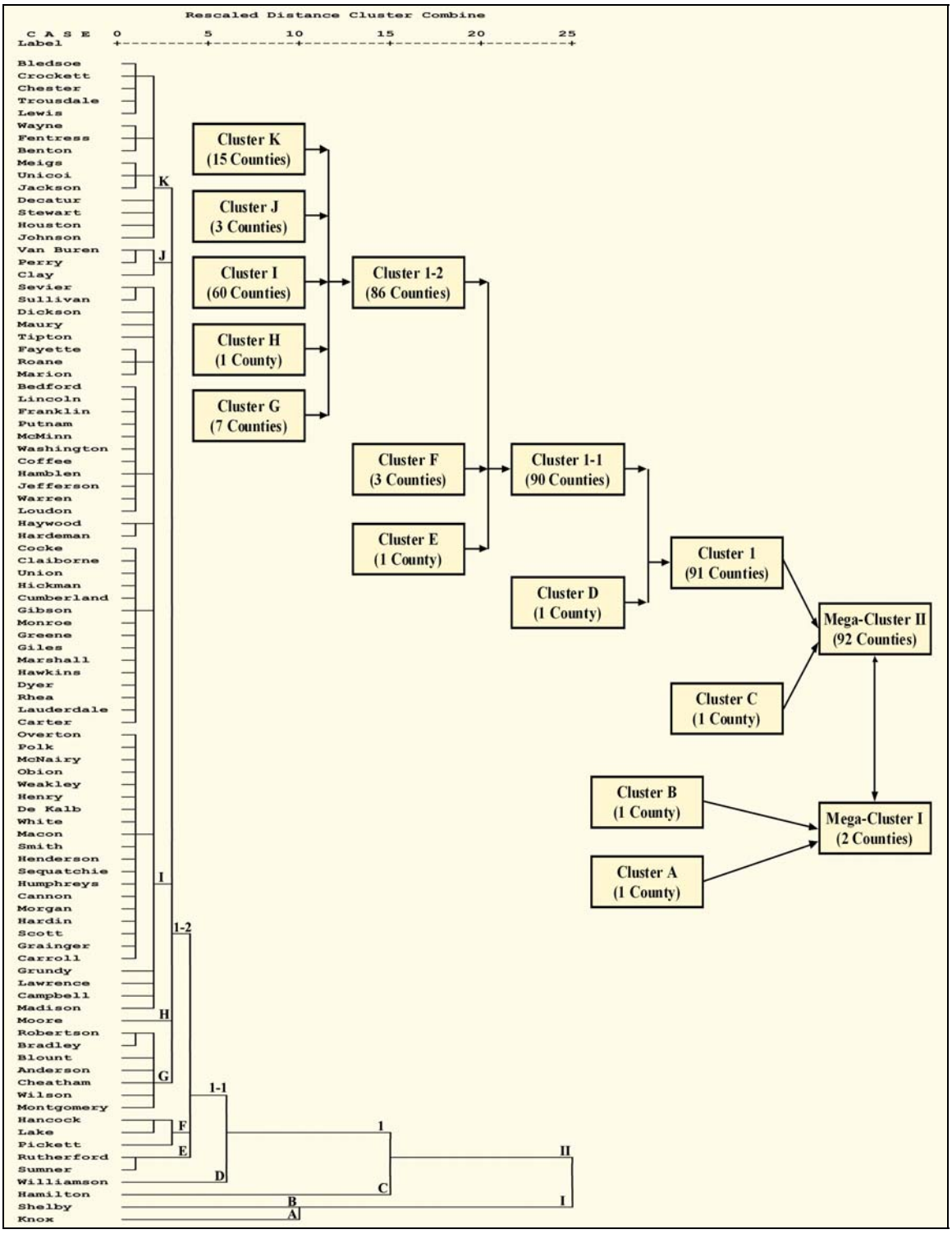


Figure 5.54 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of Tennessee, 2000

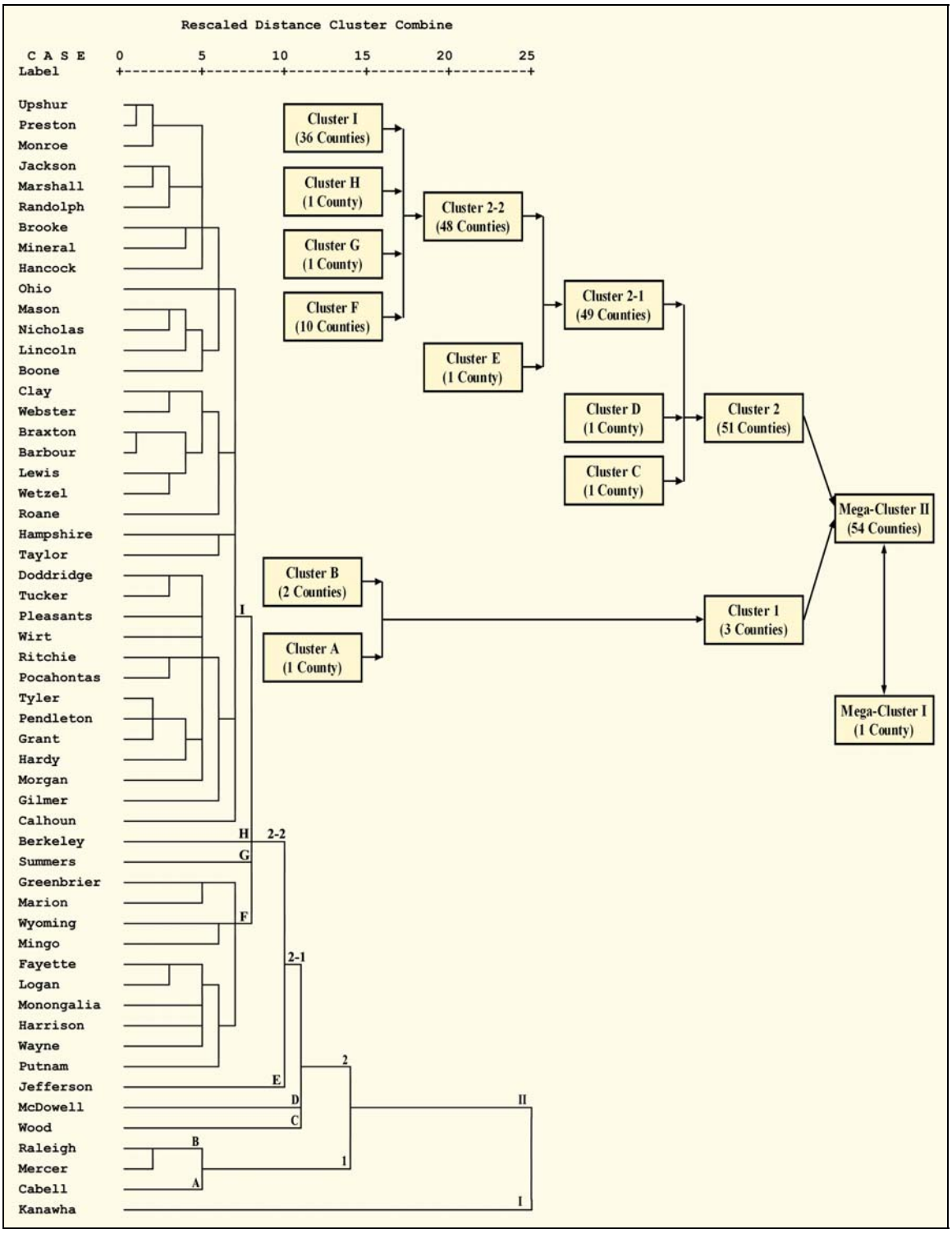


Figure 5.55 Dendrogram and Hierarchical Structure from the Hierarchical Multivariate Cluster Analysis for Social Development of West Virginia, 2000

5.1.6 Spatial Autocorrelation Analysis for 2000 Social Development Factor

Figure 5.56 shows a map of the spatial distribution (spatial cluster and spatial outliers) of the 2000 social development factor of Alabama and the associated Global Moran I. The Moran scatterplot represents the regression of a spatially lagged transformation of the 2000 social development factor (y-axis) on the original 2000 social development factor (x-axis). The slope of the scatterplot corresponds to the value for the global Moran's I, which is 0.4164, and measures the global spatial autocorrelation or the overall clustering in the social development factor dataset. The results of the spatial autocorrelation analysis show that the global Moran's I has a highly positive spatial autocorrelation in the overall dataset. The positive spatial autocorrelation means that the observation's values in relation to its neighbor are high-high (hot spots) and low-low (cold spots). The data is located in the first and third quadrants of the Moran's scatterplot. Spatial clusters (hot spots, cold spots and spatial outliers) are shown in the LISA map.

There are 7 counties in the high-high location shown in red; these are the hot spots, which mean that they are statistically significant high 2000 social development characteristics. These counties are part of Huntsville-Decatur, AL MSA, Birmingham-Hoover-Cullman, AL MSA, and Montgomery-Alexander City, AL MSA.

There are 9 counties in the low-low location; these areas are cold spots, which mean they are statistically significant low 2000 social development characteristics. These counties are located in western Alabama.

There are not any spatial outliers in the LISA cluster map.

Summary: Based on the results of the spatial autocorrelation analysis for the social development variables, the following conclusions are made:

1) The range of Moran's I is 0.2741 (South Carolina) to 0.8827 (Kentucky) with a mean of 0.5872, which indicates a positive spatial autocorrelation for each state. This means that the observation's value in relation to its neighbor is high-high and low-low; in other words, there are clusters of hot spots and cold spots where hot spots represent stronger 2000 social development characteristics, and cold spots represent weak 2000 social development characteristics.
2) The high-high clusters or hot spots are counties that are close to the interstates, counties with large cities, counties in MSAs, and neighboring counties adjacent to large cites and MSA.
3) Low-low clusters, or cold spots, are counties in urban 6 & 7 and rural counties, which are far from the interstate highways and large cities.
4) Based on the comparison with spatial cluster analysis for population growth and economic growth, the social development spatial clusters are strongly correlated with the population and economic growth spatial clusters. Economic growth spatial clusters have a stronger influence than population growth spatial clusters. The overall map for the southeast is shown in Chapter VI.

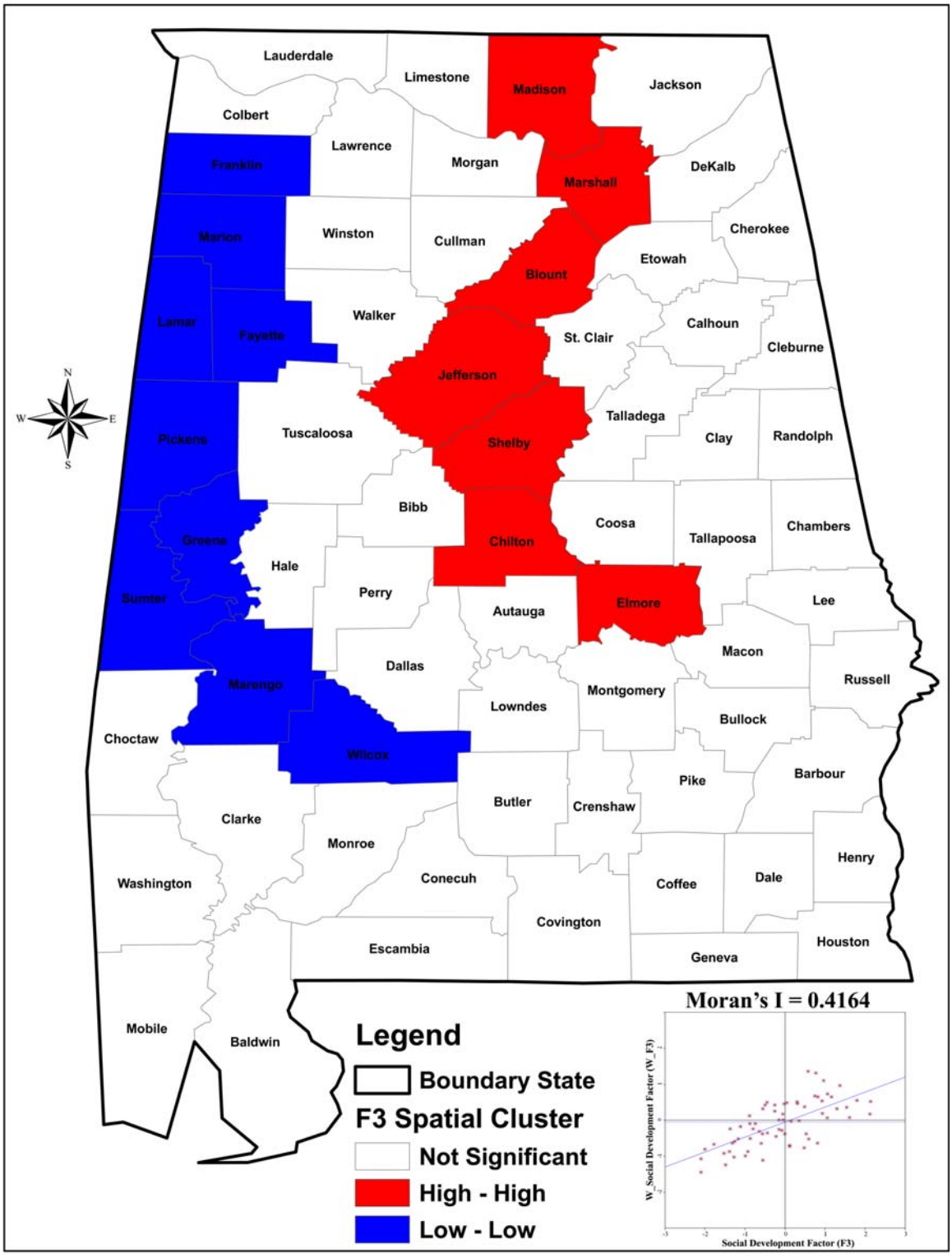


Figure 5.56 Spatial Autocorrelation Results for the Social Development Factor of Alabama, 2000

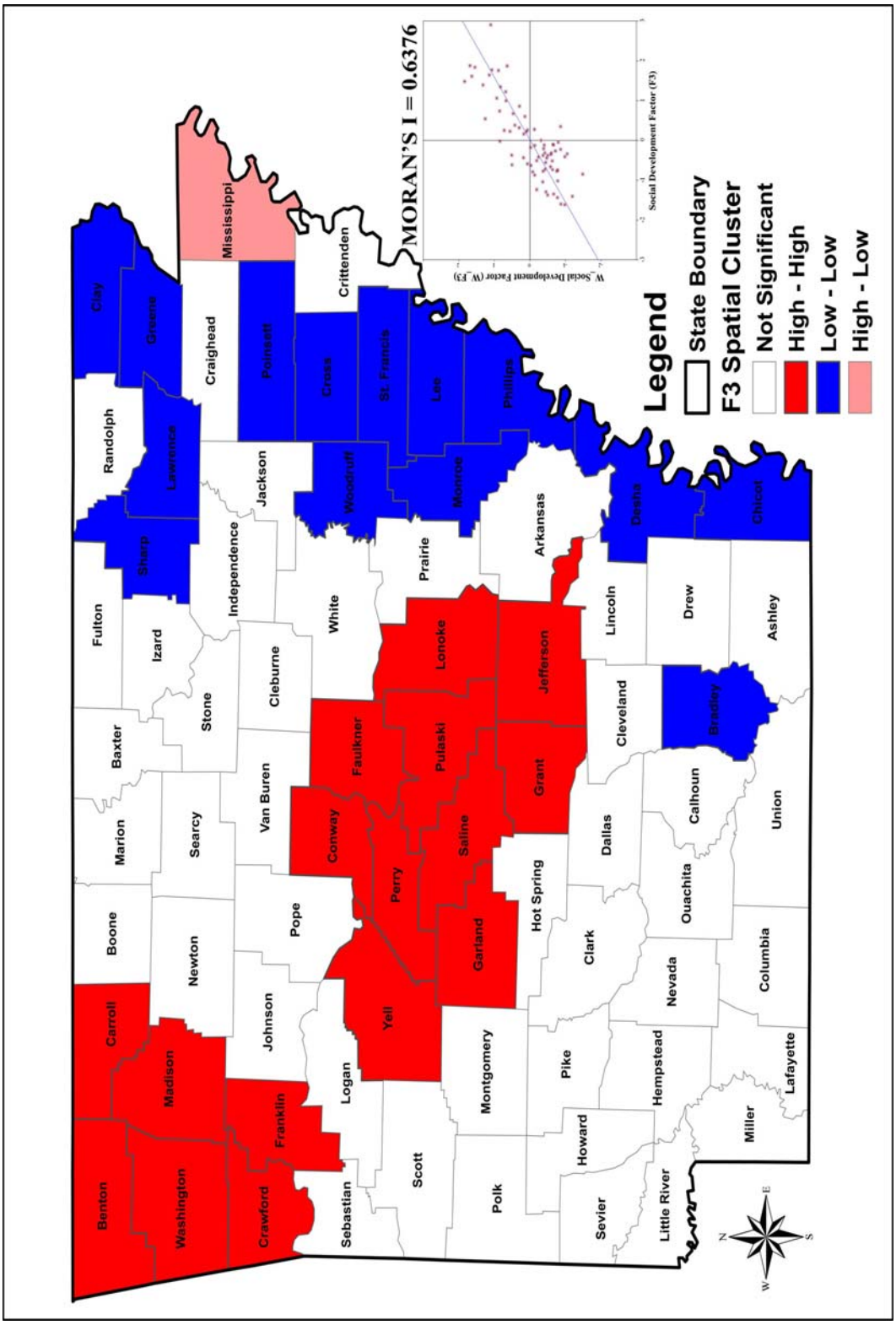


Figure 5.57 Spatial Autocorrelation Results for the Social Development Factor of Arkansas, 2000

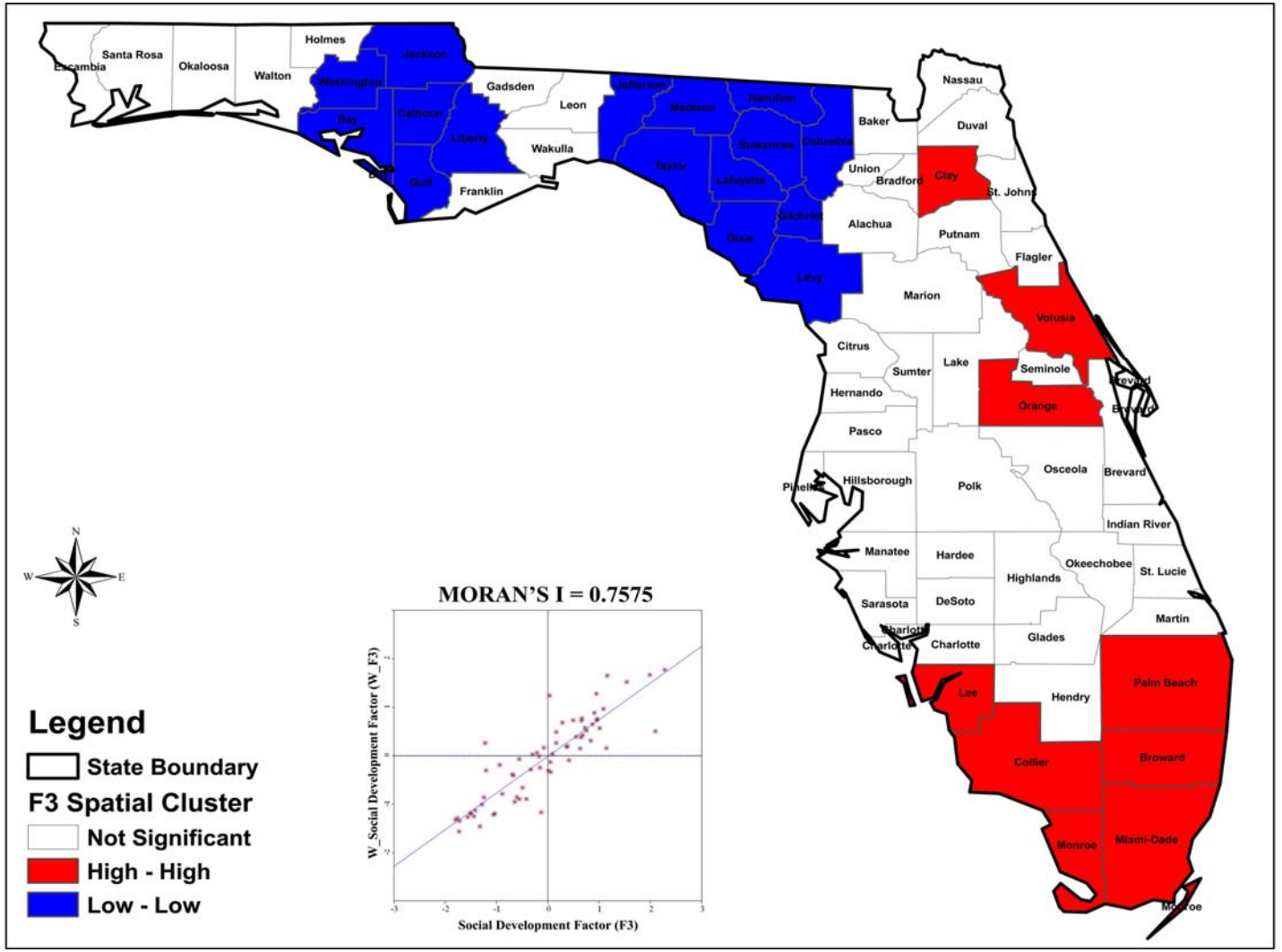


Figure 5.58 Spatial Autocorrelation Results for the Social Development Factor of Florida, 2000

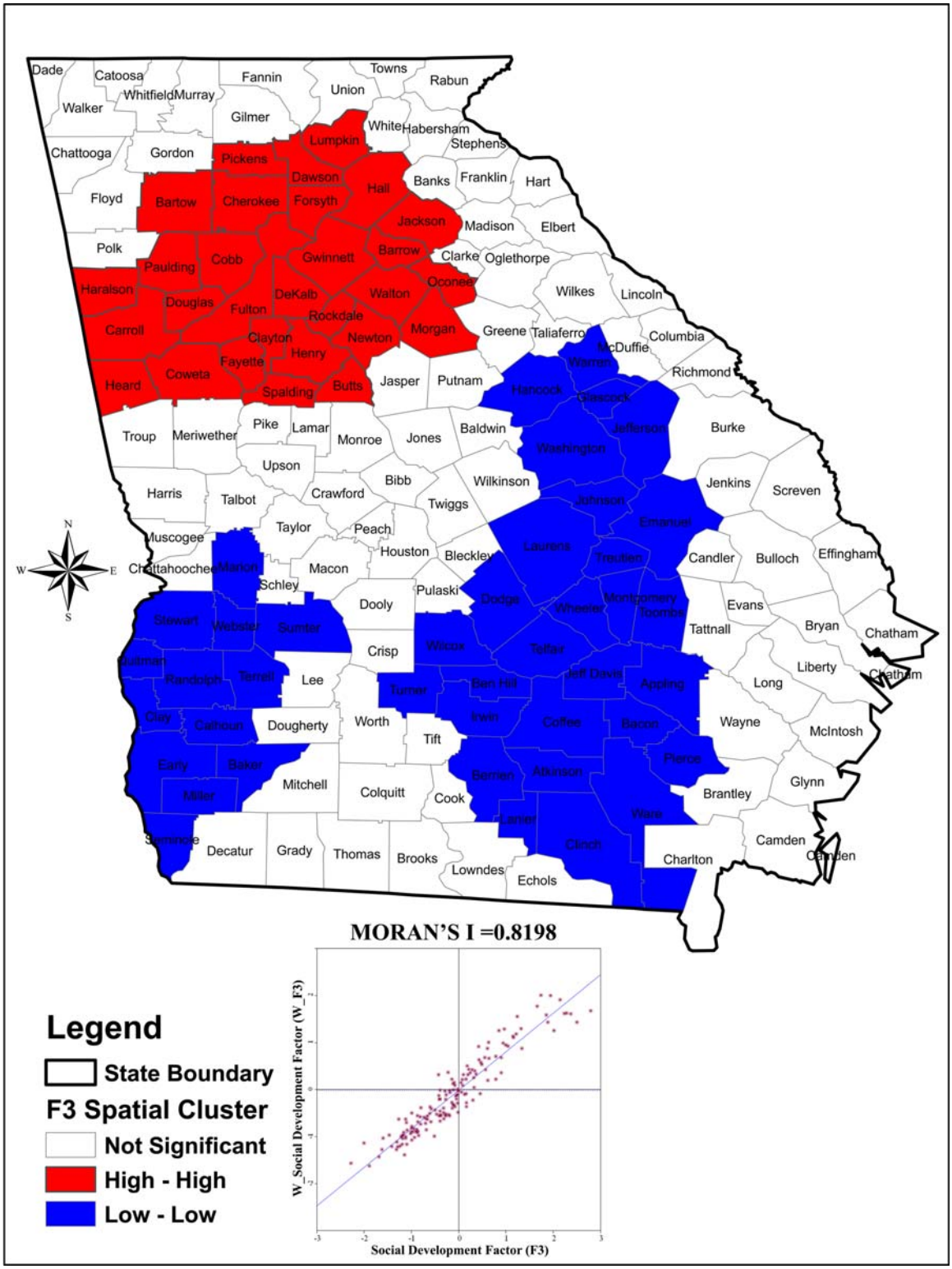


Figure 5.59 Spatial Autocorrelation Results for the Social Development Factor of Georgia, 2000

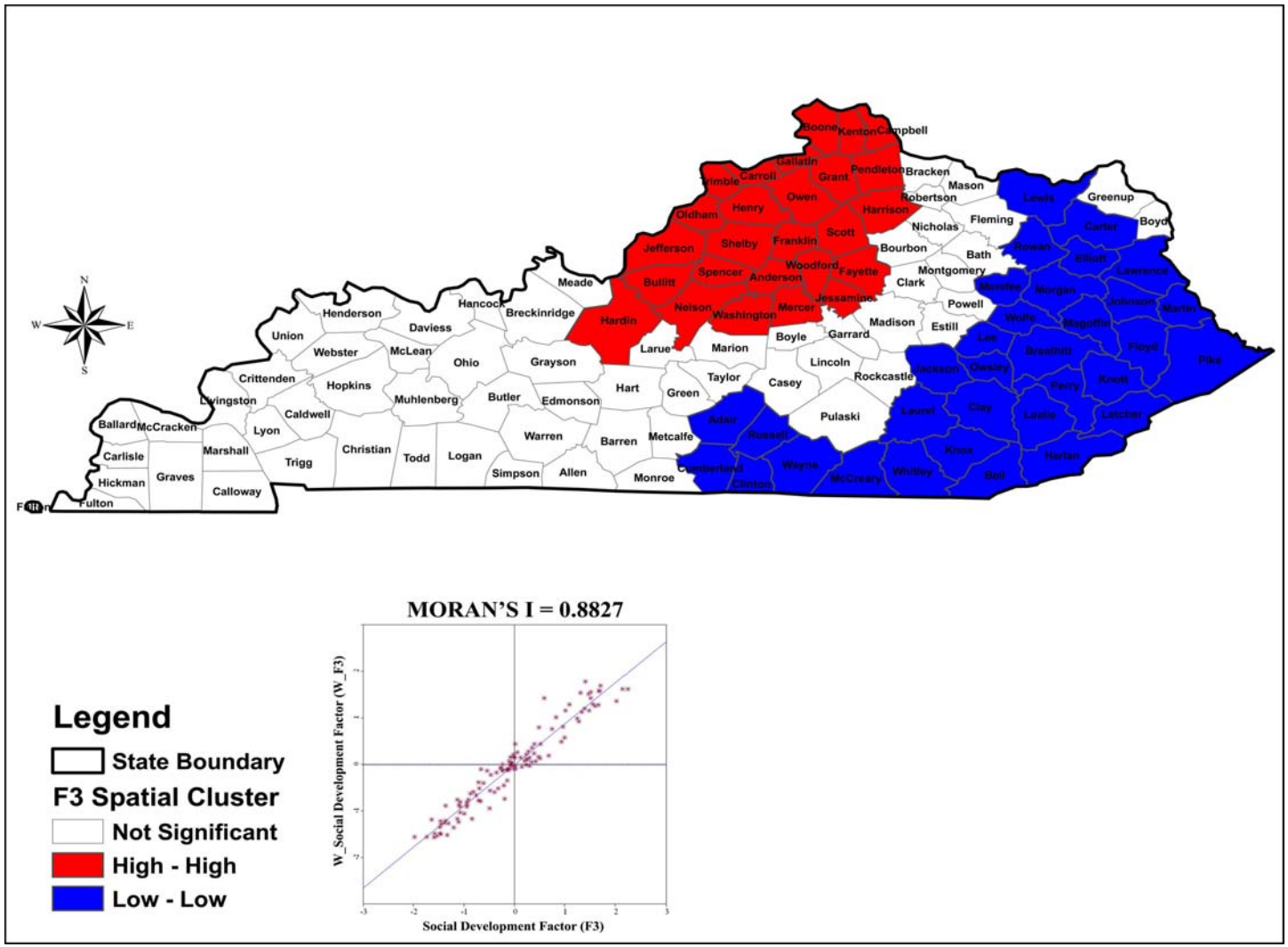


Figure 5.60 Spatial Autocorrelation Results for the Social Development Factor of Kentucky, 2000

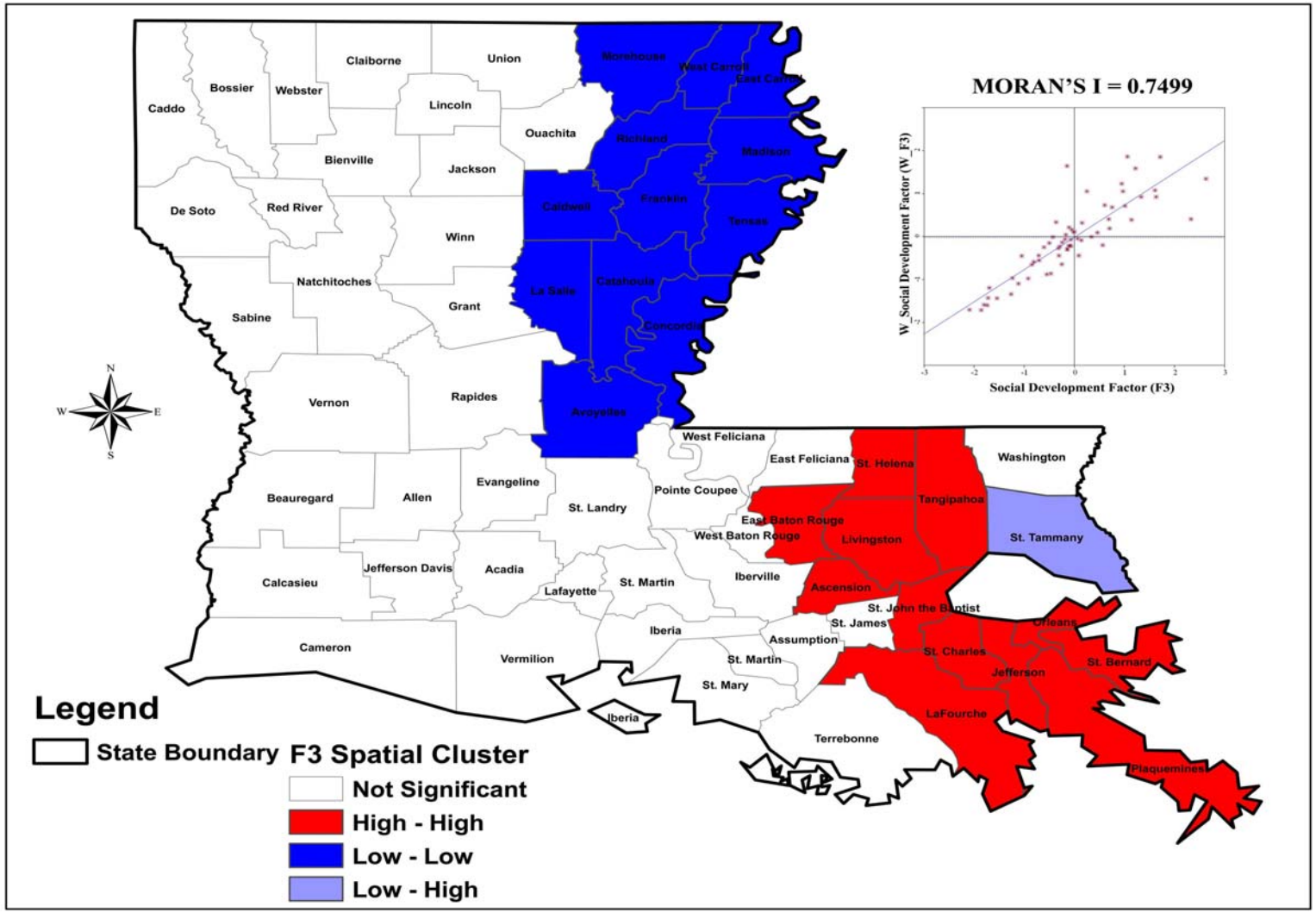


Figure 5.61 Spatial Autocorrelation Results for the Social Development Factor of Louisiana, 2000

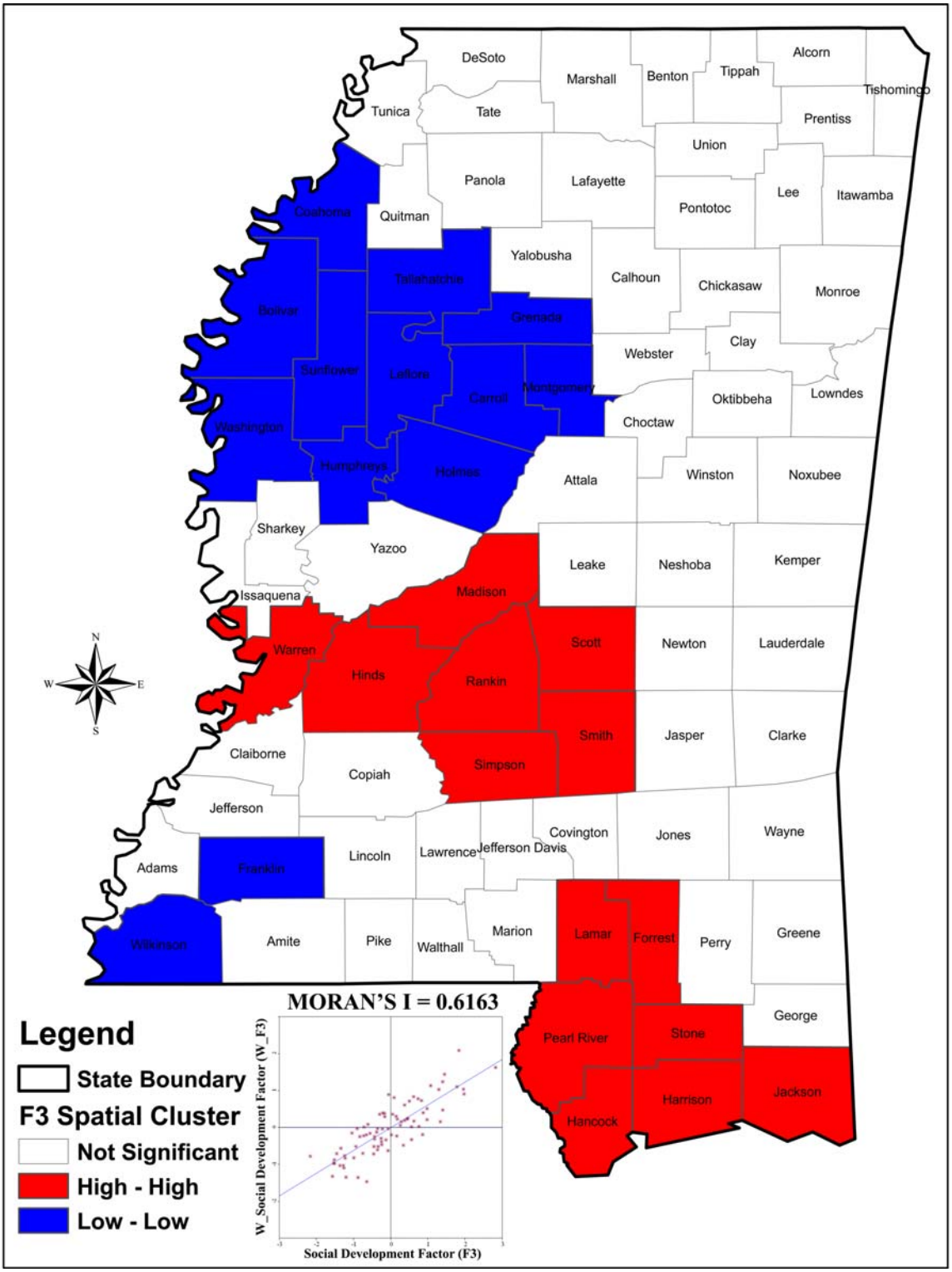


Figure 5.62 Spatial Autocorrelation Results for the Social Development Factor of Mississippi, 2000

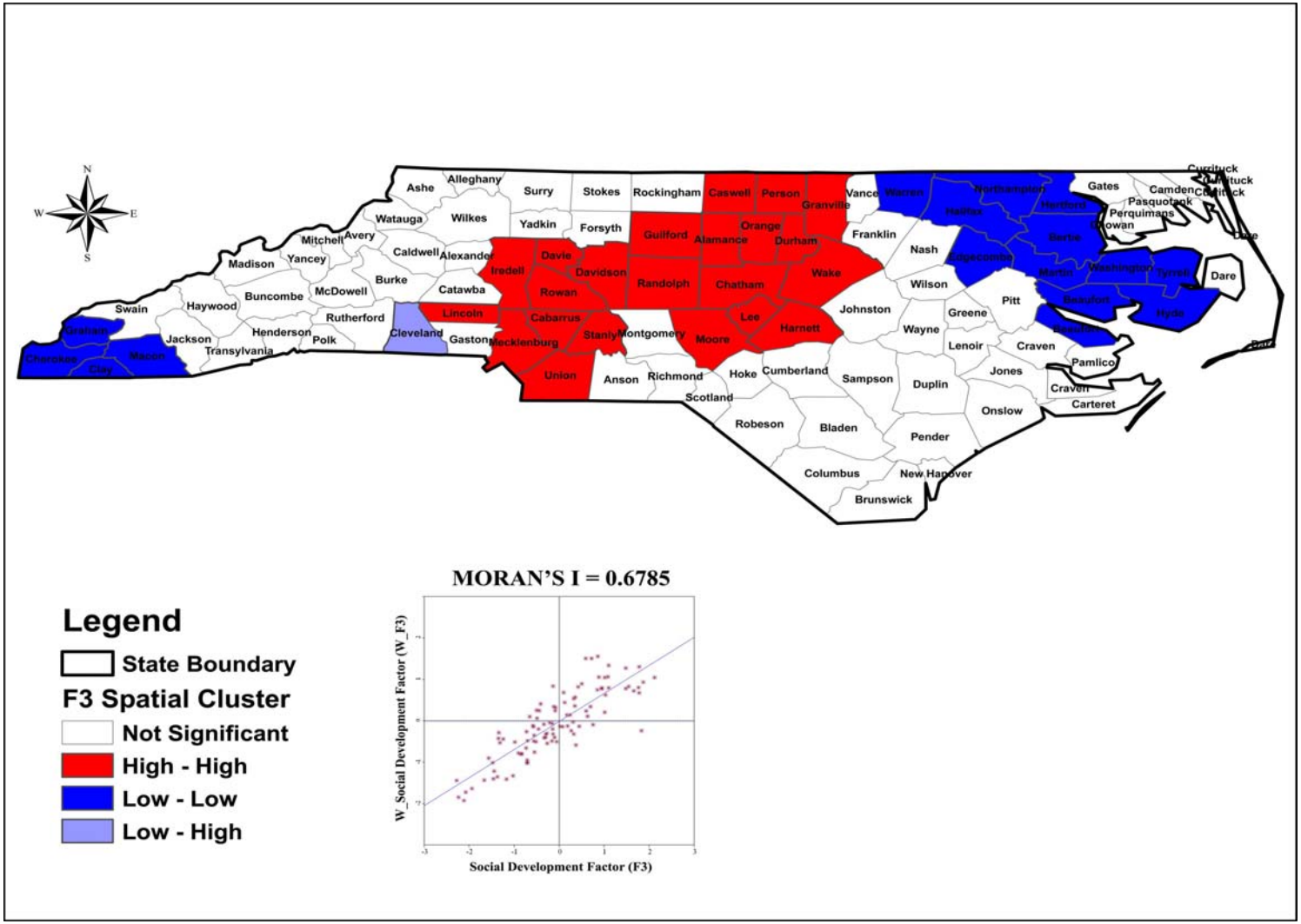


Figure 5.63 Spatial Autocorrelation Results for the Social Development Factor of North Carolina, 2000

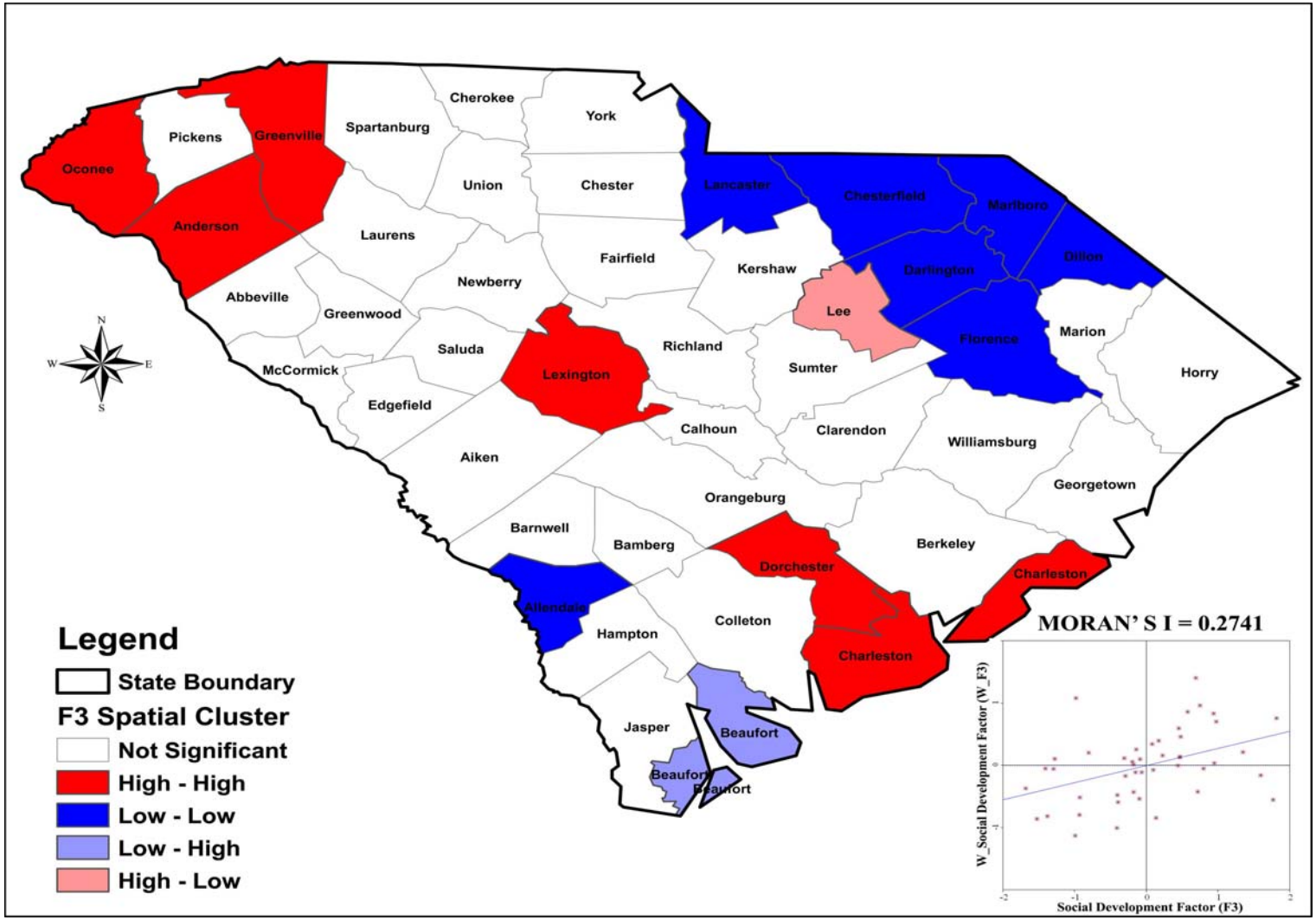


Figure 5.64 Spatial Autocorrelation Results for the Social Development Factor of South Carolina, 2000

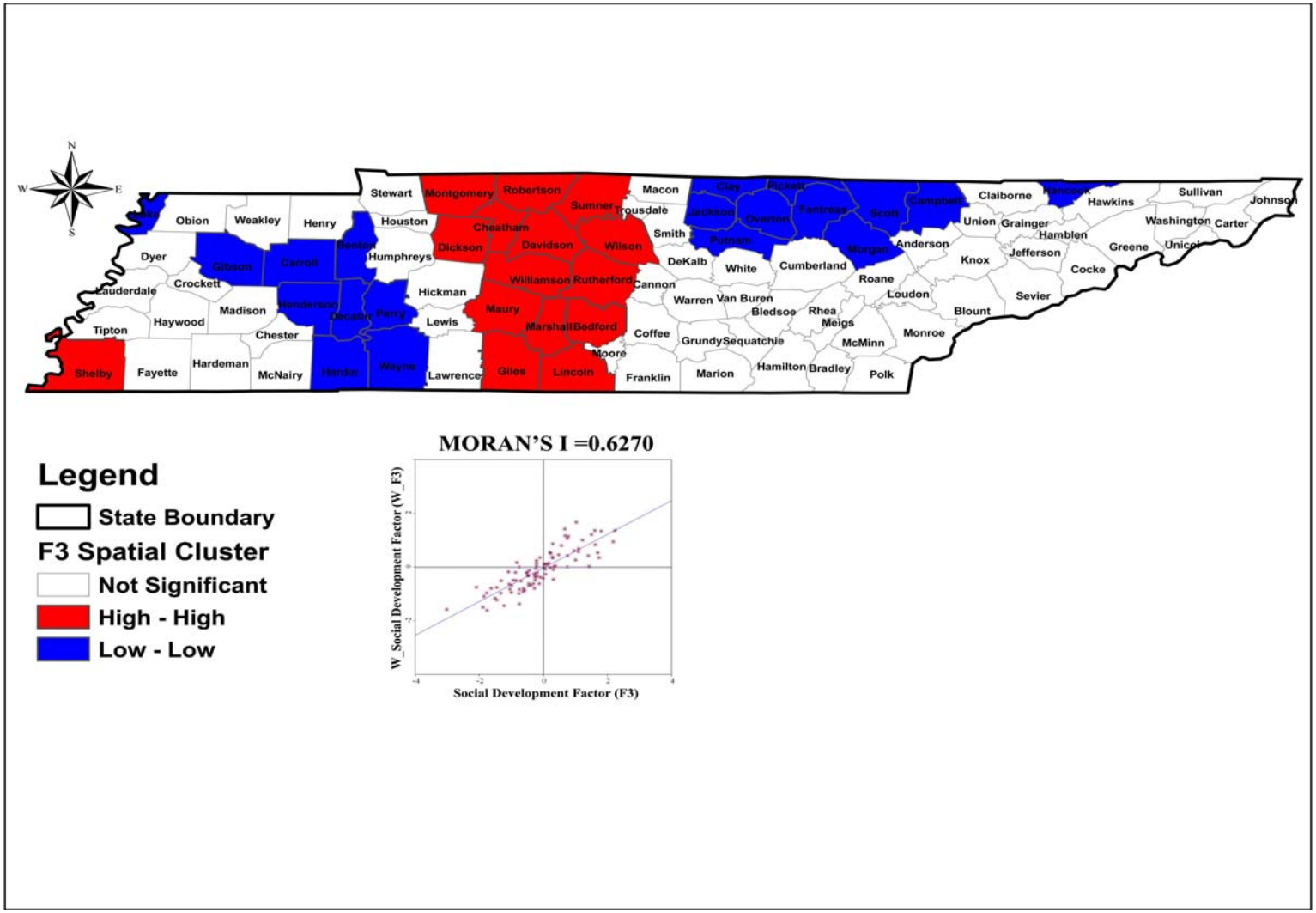


Figure 5.65 Spatial Autocorrelation Results for the Social Development Factor of Tennessee, 2000

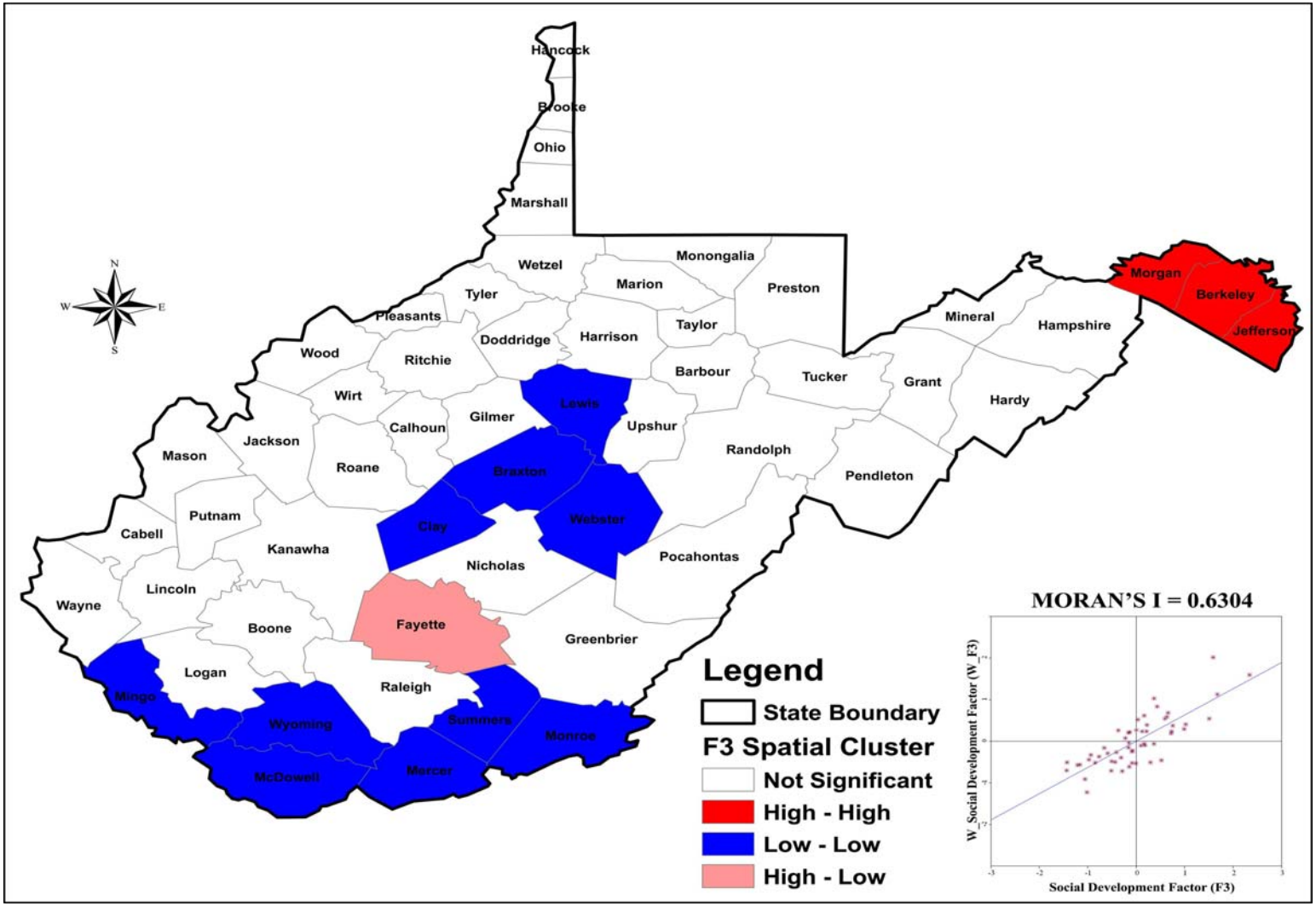


Figure 5.66 Spatial Autocorrelation Results for the Social Development Factor of West Virginia, 2000

5.2 Findings of the Measurement Models and Structural Equation Models

Results of Measurement Models: The measurement models for economic growth from 1995 to 2000, population growth from 1995 to 2000, and 2000 social development are estimated using EQS Software. Maximum likelihood estimates are being employed under the assumption of multivariate normality of the variables and errors. Results of these measurement models are equivalent to results from component axis factor analysis with varimax using SPSS.

5.2.1 Results of the Economic Growth Measurement Model

Two types of economic growth measurement models are estimated. Model type (A) has three observed variables: *PINCGRO*, *EMPGRO*, and *ESTGRO.* Model type (B) has five observed variables: *PINCGRO*, *EMPGRO*, and three establishment growth by establishment size variables: *SESTGRO* (small establishments), *MESTGRO* (medium establishments), and *LESTGRO* (large establishments). These two models are estimated for six different categories based on the rural/urban differences and coastal/ non-coastal differences.

Both models in all six categories have the values of the residual covariance matrix that are zero. The values of the residual covariance matrix ($S - \hat{\Sigma}$) are the differences between the observed covariance matrix (S) and predicted covariance matrix ($\hat{\Sigma}$). The values of the standardized residual matrix are zero (0.00). These results suggest that the model is an excellent one for the data characteristics. In both of the model output files from each category (Southeast, metro, urban 4 & 5, urban 6 & 7, and rural, coastal, and

non-coastal), chi-squared statistics for the independence model range from 30.232 to 315.016 with 3 degrees of freedom for model A. Chi-squared statistics for model B range from 46.967 to 484.226 with 10 degrees of freedom. These results indicate that the observed variables are independent; therefore, there is no point of investigating the covariance structure or small sample size issues.

The Goodness of Fit summary for the economic growth measurement type A model is reported in Table 5.1.

Table 5.1 The Goodness of Fit Index and Reliability Coefficient of the Economic Growth Measurement Model

Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	315.016	188.691	30.232	115.966	31.571	56.086	254.680
Degrees of Freedom	3	3	3	3	3	3	3
Fit Indices							
Bentler - Bonett Normed Fit Index	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Reliability Coefficients							
Cronbach's Alpha	0.592	0.671	0.630	0.565	0.423	0.544	0.600
Reliability Coefficient RHO	0.644	0.802	0.741	0.600	0.588	0.622	0.647

Table 5.1 shows the fit and reliability statistics for each category of model A (with three observed variables). Models are just identified; therefore, chi-squared statistics are not provided. Cronbach's alphas are relatively high, indicating a reliable scale, and they appear to have good internal consistency.

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Table 5.2 The Goodness of Fit Index and Reliability Coefficient of the Economic Growth Measurement Model by Size of Establishments

Summary Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	484.226	329.297	46.97	161.678	48.512	84.153	401.730
Degrees of Freedom	10	10	10	10	10	10	10
Chi - Square	35.161	10.701	3.024	22.364	6.567	6.592	35.981
Degrees of Freedom	5	5	5	5	5	5	5
Probability value for the Chi-Square Statistics	0.0000	0.05764	0.696	0.00045	0.2549	0.25279	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index (NFI)	0.927	0.968	0.936	0.862	0.865	0.922	0.910
Bentler - Bonett Non-Normed Fit Index (NNFI)	0.873	0.964	1.107	0.771	0.919	0.957	0.842
Comparative Fit Index (CFI)	0.936	0.982	1.000	0.886	0.959	0.979	0.921
Bollen's (IFI) Fit Index	0.937	0.982	1.047	0.889	0.964	0.980	0.922
Root Mean-Square Residual (RMR)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Reliability Coefficients							
Cronbach's Alpha	0.352	0.581	0.541	0.232	0.108	0.338	0.354

Table 5.2 reports the goodness of fit summary for the economic growth measurement model B. The proposed model's chi-squared statistics for the Southeast, counties in MSA, urban 6 & 7 counties, and non-coastal counties provides a significance test failing to refute the hypothesis that the model fits the observed data. However, p values of the chi-squared statistics for urban 4 & 5 counties, rural counties, and coastal counties are above 0.25, which suggest that the models supporting the alternative hypothesis do not fit the observed data. Moreover, Cronbach's alphas[1] (Cronbach, Lee J., 1951) are not high which indicates that the model is not highly reliable.

[1] Cronbach's alpha is an estimator of reliability that implies the component can have different means and different variances, however, their covariances should all be equal. This implies that they have 1 common factor in a factor analysis. Generally, it is required to have a reliability of 0.70 or higher. However, the appropriate degree of reliability depends upon the use of the instrument.

However, Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI are close to one; RMR is zero[2]. Bentler-Bonnet NNFI for urban 4 & 5 counties is 1.107. Bentler-Bonnet NNFI can be greater than 1 when the fit of the overidentified model is almost perfect. Bentler-Bonnet NNFI for urban 6 & 7 counties is 0.771, which is less than 0.80 and suggests that a value or values of the residual correlation is greater than 0.15. This suggested that there is a need to check the covariance structure of the residuals. The preponderance of evidence from the goodness of fit indices suggests that the model generally fits the data for all categories, except urban 6 & 7.

In terms of goodness of fit, the first measurement model (model A), with three observed variables, is much better than the second measurement model (model B), with five observed variables, for all categories.

Figure 5.67 illustrates the unstandardized regression results of the path analysis of the economic growth measurement model (A) for the Southeast.

[2] NFI, CFI – (Normed Fit Index & Comparative Fit Index) (Bollen, Kenneth A., 1989, Byrne, Barbara M., 2006, Hoyle, Rick H., 1995) values range from zero to 1.00. They are derived from comparison between the hypothesized and independence models in which each provides a measure of complete covariation in the data. A well fit is more than 0.90. Less than 80 is considered model do not fit the observed data

NNFI – (Non-Normed Fit Index) (Bollen, Kenneth A., 1989, Byrne, Barbara M., 2006, Hoyle, Rick H., 1995) a variant of the NFI which takes the model complexity into consideration. Values for NNFI can surpass values reported for NFI and can range outside the zero to 1.00 margins.

IFI – (Incremental Fit Index) (Bollen, Kenneth A., 1989, Byrne, Barbara M., 2006, Hoyle, Rick H., 1995) represents a derivative of the NFI. Values can span from zero to 1.00, with .95 demonstrating a superior fit. Only difference between IFI and NFI is the consideration of the degree of freedom.

RMR – (Root Mean Square Residual) (Byrne, Barbara M., 2006) "represents the average residual value derived from the fitting of the variance-covariance matrix for the hypothesized model $\Sigma(\theta)$ to the variance-covariance matrix of the sample data (S)." "RMR represent the average value across all standardized residuals and ranges from zero to 1.00; in a well-fitting model, this value is small – approximately 0.05 or less" (Byrne, Barbara M., 2006).

Figure 5.67 Unstandardized Regression Results for Economic Growth Measurement Model (A) for the Southeast

Regression coefficient *EMPGRO* has a value of one ($\alpha_{12} = 1$). In fact, it is not an estimate. It was constrained to be 1 by the model. The estimated coefficient for *PINCGRO* is 0.332 ($\alpha_{11} = 0.332$), and the associated precision of estimate (standard error) is 0.039. The estimated coefficient for *ESTGRO* is 0.987 ($\alpha_{13} = 0.987$), and the associated precision of estimate (standard error) is 0.120. The ratio of regression coefficient to the standard error is regarded as a test statistic for the null hypothesis that the given parameter is zero and the corresponding z-statistics are 8.51 and 8.225 respectively, suggesting a failure to accept null hypothesis. The variances of the error terms or residuals are estimated as 0.000 for each observed variable for economic growth factor, suggesting that estimates are very precise, and the model is just-identified.

Equation 5-1 represents the standardized solution for the economic growth measurement model for the Southeast.

$$\begin{aligned} PINCOME = V_1 &= 0.429 \cdot F_1 + 0.903 \cdot E_1 & R^2 &= 0.184 \\ EMPGRO = V_2 &= 0.659 \cdot F_1 + 0.752 \cdot E_2 & R^2 &= 0.434 \\ ESTGRO = V_3 &= 0.673 \cdot F_1 + 0.740 \cdot E_3 & R^2 &= 0.453 \end{aligned} \qquad (5-1)$$

The unstandardized parameter estimates are rescaled by the following standardization of both latent variables (*F1*) and the residuals (*E1*, *E2*, and *E3*). Consider *EMPGRO* estimates. $Var(V_2) = Var(E_2) = 1$ (from Figure 5.67), then $Var(V_2) = 0.659^2 + 0.752^2 = 1$, which suggests communality (the proportion of the variance *EMPGRO* explained by common factor, *F1*), or the reliability of the economic growth. The R^2 is $1 - 0.752^2 = 0.659^2 = 0.434$ (Dunn, G., B. Everitt and A. Pickles, 1993). Similarly:

$$Var(V_1) = 0.429^2 + 0.903^2$$
$$Var(V_2) = 0.673^2 + 0.740^2$$

The corresponding reliabilities, or R^2, are calculated in that $0.429^2 = 0.184$ and $0.673^2 = 0.453$, respectively.

Tables 5.3 and 5.4 report the standardized regression results from both economic growth measurement models A and B.

Table 5.3 Standardized Regression Results for Economic Growth Measurement Model -A

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.429	0.184	0.256	0.065	0.450	0.203	0.532	0.283	0.282	0.079	0.299	0.089	0.459	0.210
EMPGRO	*F1*	0.659	0.434	0.962	0.925	0.828	0.685	0.647	0.419	0.295	0.087	0.707	0.500	0.650	0.422
ESTGRO	*F1*	0.673	0.453	0.736	0.542	0.643	0.413	0.540	0.291	0.911	0.830	0.624	0.389	0.676	0.458

Table 5.4 Standardized Regression Results for Economic Growth Measurement Model –B

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.419	0.176	0.202	0.041	0.471	0.222	0.588	0.346	0.312	0.097	0.311	0.097	0.446	0.199
EMPGRO	*F1*	0.587	0.434	0.695	0.483	0.717	0.514	0.588	0.345	0.367	0.135	0.575	0.331	0.586	0.344
SESTGRO	*F1*	0.739	0.546	0.982	0.965	0.706	0.499	0.527	0.278	0.731	0.535	0.718	0.515	0.738	0.544
MESTGRO	*F1*	0.396	0.156	0.598	358	0.252	0.064	0.252	0.064	0.301	0.091	0.339	0.115	0.409	0.167
LESTGRO	*F1*	0.264	0.007	0.42	0.177	0.525	0.275	0.231	0.054	0.088	0.008	0.292	0.085	0.26	0.068

Based on the standardized regression results for Model A for all categories, economic growth factor (*F1*) has a positive effect on *PINCGRO*, *EMPGRO,* and *ESTGRO*. Comparing the factor loadings for the economic growth factor, the average annual rate of change in employment (*EMPGRO)* is strongest, followed by the average annual rate of change in the number of establishment (*ESTGRO)*, and finally the average annual rate of change in per capita personal income (*PINCGRO*). In other words, comparing the magnitude of the effect of *F1* on *PINCGRO*, *EMPGRO*, and *ESTGRO*, the effect on *EMPGRO* is the strongest, followed by *ESTGRO*, and finally *PINCGRO*.

Based on the standardized regression results for Model B for all categories, economic growth factor (*F1*) has a positive effect on *PINCGRO*, *EMPGRO, SESTGRO*, *MESTGRO*, and *LESTGRO*. When comparing the factor loadings for the economic growth factor, small sized establishment growth (*SESTGRO*) has the strongest effect, followed by employment growth variable (*EMPGRO*). Next in strength of effect is either per capita personal income growth (*PINCGRO*) or medium sized establishment growth

(*MESTGRO*). Finally, the large sized establishment growth (*LESTGRO*) has the weakest effect.

5.2.2 Results of the Population Growth Measurement Model

The economic growth measurement model, with three observed variables (*LNDENGRO, LNIMR*R, and *LNOMRR*), was estimated for six different categories based on the rural/urban differences and coastal/ non-coastal differences.

From the output files from both models in all six categories, the values of the residual covariance matrix, ($S - \hat{\Sigma}$), are relatively small; most covariance of residuals are zero except residuals covariance between (*LNOMRR* and *LNDENGRO)* and (*LNOMRR* and *LNIMRR*), which are close to zero (range of -0.01 to 0.05) for the unstandardized residual matrix. The range of the average absolute residual for all six categories is from 0.0002 to 0.001. The range of the average off-diagonal absolute residual is 0.0010 to 0.0019. For the standardized residual matrix, the range of the average absolute standardized residual is from 0.0208 to 0.0772, and the average off-diagonal absolute residual is 0.0415 to 0.1536. These results suggest that the model is reasonable for the data but could use improvement.

In the population growth measurement model's output file from each category (southeast, metro, urban 4 & 5, urban 6 & 7, and rural, coastal, and non-coastal), the independence model chi-squared statistics (817.915 to 10551.762 with 4 degrees of freedom) indicate that the observed variables are independent. Table 5.5 reports the goodness of fit summary for the population growth measurement model.

Table 5.5 The Goodness of Fit Index and Reliability Coefficient of the Population Growth Measurement Model

Summary Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	10559.762	2836.905	817.915	3303.148	2466.533	2930.630	7551.159
Degrees of Freedom	4	4	4	4	4	4	4
Chi - Square	233.087	158.845	37.677	122.439	6.388	61.07	169.977
Degrees of Freedom	1	1	1	1	1	1	1
Probability value for the Chi-Square Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index (NFI)	0.978	0.944	0.954	0.963	0.997	0.979	0.977
Bentler - Bonett Non-Normed Fit Index (NNFI)	0.912	0.777	0.820	0.853	0.991	0.918	0.910
Comparative Fit Index (CFI)	0.978	0.944	0.955	0.963	0.998	0.979	0.978
Bollen's (IFI) Fit Index	0.978	0.944	0.955	0.858	0.998	0.979	0.978
Root Mean-Square Residual (RMR)	0.001	0.002	0.001	0.001	0.000	0.001	0.001
Reliability Coefficients							
Cronbach's Alpha	0.491	0.541	0.610		0.364	0.536	0.470

The model's chi-squared statistics (p_values are zero) for all six categories provide a significance test for the hypothesis that the model fits the observed data. The Cronbach's alphas are less than 0.70, which indicates that the model is not of a highly reliable scale. However, Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI are significantly close to one; RMR is almost zero. Lower Bentler-Bonnet NFI and Bentler-Bonnet NNFI (less than 0.80) are explained by an absolute value of the correlation residuals having a value greater than 0.15. The goodness of fit indices suggests that the model fits the data.

Parameter estimates, standard errors, and R-squared are analyzed. Figure 5.68 illustrates the unstandardized regression results of the path analysis of the population growth measurement model for the Southeast.

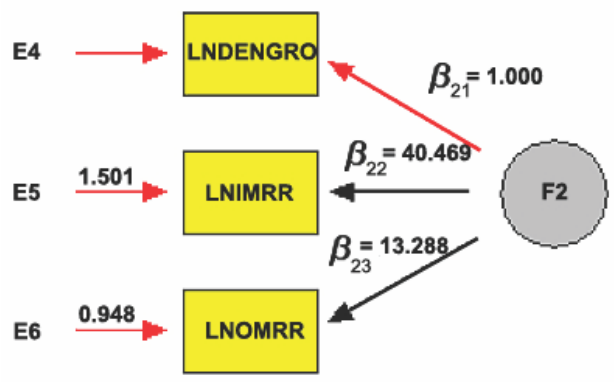

Figure 5.68 Unstandardized Regression Results for Population Growth Measurement Model for the Southeast

The regression coefficient for *LNDENGRO* has a value of one ($\beta_{21} = 1$). It is not an estimate. It was constrained to be 1 by the model. The coefficient estimate for *LNIMRR* is 40.469 ($\beta_{22} = 40.469$), and the precision of estimate (standard error) is 1.501. For *LNOMRR* the coefficient estimate is 13.288 ($\beta_{23} = 13.288$), and the precision of estimate (standard error) is 0.948. The ratio of the regression coefficient to the standard error is regarded as a test statistics for the null hypothesis that the given parameter is zero. The corresponding z-statistics are 29.98 and 14.017 respectively. Those results suggest rejection of the null hypothesis. The variances of the error terms or residuals from the output files are estimated as 0.000 (*LNDENGRO*), 0.01 (*LNOMRR*), and 0.05 (*LNIMRR*) for the population growth factor; this suggests that the estimates are precise. Equation 5-2 represents the standardized solution for the economic growth measurement model for the Southeast.

$$\begin{aligned} LNDENGRO = V_4 &= 0.689 \cdot F_1 + 0.725 \cdot E_4 && R^2 = 0.475 \\ LNIMRR = V_5 &= 0.963 \cdot F_1 + 0.268 \cdot E_5 && R^2 = 0.928 \\ LNOMRR = V_6 &= 0.483 \cdot F_1 + 0.876 \cdot E_6 && R^2 = 0.233 \end{aligned} \qquad (5\text{-}2)$$

Table 5.6 reports the standardized regression results from the population growth measurement model.

Table 5.6 Standardized Regression Results for Population Growth Measurement Model

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
LN_DENGRO	*F2*	0.689	0.475	0.687	0.726	0.413	0.911	0.686	0.470	0.687	0.472	0.626	0.392	0.712	0.507
LN_IMRR	*F2*	0.963	0.928	0.962	0.272	0.968	0.250	0.952	0.907	0.964	0.929	0.97	0.941	0.961	0.923
LN_OMRR	*F2*	0.483	0.233	0.534	0.845	0.712	0.703	0.367	0.135	0.339	0.115	0.582	0.339	0.441	0.194

Based on the standardized regression results for the population growth measurement model, the population growth factor has a positive effect on the average annual rate of change in the population density (*LNDENGRO*), in-migration rate (*LNIMRR*), and out-migration rate (*LNOMRR*). The population growth factor has the strongest effect on *LNIMRR*, followed by *LNDENGRO*, *LNOMRR* for the Southeast, urban 6 & 7, rural, and coastal, and non-coastal counties. The population growth factor has the strongest effect on *LNDENGRO*, followed by *LNOMRR*, and finally *LNIMRR* for counties in MSA and urban 4 & 5 counties.

5.2.3 Results of the 2000 Social Development Measurement Model

The 2000 social development measurement model, with three observed variables (*ECON_00, EDUC_00*, and *HOUS_00*), is estimated for six different categories based on the rural/urban differences and coastal/non-coastal differences.

From the output files for both models in all six categories, values of the residual covariance matrix ($S - \hat{\Sigma}$) are zero (0.00). The values of the standardized residual matrix

are also zero (0.00). These suggest that the model is an excellent model for the data. In the 2000 social development model results for each category (southeast, metro, urban 4 & 5, urban 6 & 7, and rural, coastal, and non-coastal), the independence model chi-squared statistics ranges from 45.420 to 1081.494 with 3 degrees of freedom These results indicate that the observed variables are independent. Table 5.7 reports the goodness of fit summary for the 2000 social development measurement model.

Table 5.7 The Goodness of Fit Index and Reliability Coefficient of the Social Development Measurement Model

Summary Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	13549.407	4040.471	1010.969	4491.787	3066.516	3645.405	9909.661
Degrees of Freedom	37	38	38	39	38	37	37
Chi - Square	1118.753	707.945	100.292	788.376	3066.516	287.607	875.939
Degrees of Freedom	26	28	38	29	28.000	27	27
Probability value for the Chi-Square Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index	0.917	0.825	0.901	0.824	0.899	0.921	0.912
Bentler - Bonett Non-Normed Fit Index	0.885	0.769	0.899	0.771	0.873	0.901	0.882
Comparative Fit Index (CFI)	0.919	0.830	0.926	0.829	0.907	0.928	0.914
Bollen's (IFI) Fit Index	0.919	0.831	0.926	0.83	0.907	0.928	0.914
Root Mean-Square Residual (RMR)	0.003	0.005	0.004	0.004	0.006	0.004	0.003
Reliability Coefficients							
Cronbach's Alpha	0.592	0.625	0.682	0.584	0.558	0.664	0.696

From Table 5.7, the 2000 social development measurement model, with three observed variables, for all six categories are overall significant and fit the data. The models are perfectly identified (significant), and therefore, the chi-squared statistics are not provided. Cronbach's alphas are substantially higher (closer to 0.70), which indicated a reliable scale and appeared exceptional internal consistency.

The parameter estimates, standard errors, and R-squared are studied. Figure 5.69 illustrates the unstandardized regression results of the path analysis of the 2000 social development measurement model for the Southeast.

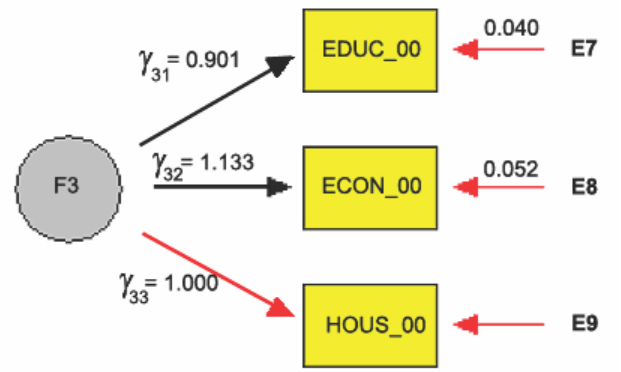

Figure 5.69 Unstandardized Regression Results for Social Development Measurement Model for the Southeast

The regression coefficient *HOUS_00* has a value of one ($\gamma_{31} = 1$) because it was constrained to be 1 by the model. The coefficient estimate for *EDUC_00* is 0.901 ($\gamma_{32} = 0.901$), and the precision of the estimate (standard error) is 0.040. The coefficient estimate for *ECON_00* is 1.033 ($\gamma_{23} = 1.133$), and the precision of the estimate (standard error) is 0.052. The ratio of the regression coefficient to the standard error is regarded as a test statistics for the null hypothesis that the given parameter is zero and corresponding z-statistics are 22.525 and 2179 respectively; this suggests to reject the null hypothesis. The variances of the error terms or residuals are estimated as 0.007 (*HOUS_00*), 0.006 (*EDUC_00*), and 0.015 (*ECON_00*) for the 2000 social development growth factor. These results indicate that the estimates are precise. Equation 5-3 represents the

standardized solution for the 2000 social development measurement model for the Southeast.

$$
\begin{aligned}
EDUC_00 = V_7 &= 0.807 \cdot F_1 + 0.590 \cdot E_7 \qquad R^2 = 0.651 \\
ECON_00 = V_8 &= 0.750 \cdot F_1 + 0.662 \cdot E_8 \qquad R^2 = 0.562 \\
HOUS_00 = V_9 &= 0.818 \cdot F_1 + 0.576 \cdot E_9 \qquad R^2 = 0.669
\end{aligned}
\tag{5-3}
$$

Table 5.8 reports the standardized regression results for the 2000 social development measurement model.

Table 5.8 Standardized Regression Results for Social Development Measurement Model

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
EDUC_00	*F3*	0.807	0.651	0.873	0.762	0.649	0.422	0.476	0.227	.589*	0.347	0.846	0.716	0.799	0.638
ECON_00	*F3*	0.750	0.562	0.631	0.399	0.636	0.405	0.665	0.443	0.791	0.625	0.821	0.674	0.733	0.537
HOUS_00	*F3*	0.818	0.669	0.628	0.394	0.855	0.730	0.852	0.726	0.777	0.604	0.727	0.529	0.847	0.718

Based on the standardized regression results for model (A) for all categories, the 2000 social development factor (*F3*) has a positive effect on *ECON_00*, *EDUC_00,* and *HOUS_00*. When comparing the factor loadings for the 2000 social development factor, the strength of each variable is similar. When comparing the factor loadings for the 2000 social development factor, the housing dimension index (*HOUS_00*) is strongest, followed by the education dimension index (*EDUC_00*) and the economic opportunity dimension index (*ECON_00*) for the Southeast, urban 4 & 5 counties, and non-coastal counties. For counties in MSAs, the effect of F3 on *EDUC_00* is the strongest, followed by *ECON_00*, and *HOUS_00.* For urban 6 & 7 counties, the effect of F3 on *HOUS_00* is

the strongest, then *ECON_00* and *EDUC_00*. When comparing the magnitude of the effect of *F3* on *ECON_00*, *EDUC_00*, and *HOUS_00,* they are all similar.

The effect of *F3* on *HOUS_00* is strongest, followed by *EDUC_00*, then *ECON_00* for the Southeast, urban 4 & 5 counties, and non-coastal counties. The effect of *F3* on *EDUC_00* is strongest, followed by *ECON_00* and then *HOUS_00* for counties in MSA. *F3* on *HOUS_00* is the strongest effect, followed by *ECON_00* and then *EDUC_00* for urban 6 & 7counties. *F3* on *ECON_00* is the strongest effect, followed by *HOUS_00* and then *EDUC_00* for rural counties.

Results of Structural Equation Models: Since the results of measurement models suggest that the models are good fits for the data characteristics and observed variables are independent, the next step is to combine these three measurement models and build a structural equation model. The following four types of the structural equation model are estimated:

1) Full Structural Equation Model I–A (SEM I-A) with 9 observed endogenous variables and three latent variables.
2) Full Structural Equation Model I–B (SEM I-B) with 11 observed dependent variables and three latent variables.
3) Full Structural Equation Model II–A (SEM II-A) with 16 observed variables (9 endogenous variables and 7 exogenous variables).
4) Full Structural Equation Model II–B (SEM II-B) with 16 observed variables (9 endogenous variables and 4 exogenous variables).

All structural equation models are estimated for six different categories based on the rural/urban differences and coastal/non-coastal differences.

5.2.4 Findings from Full Structural Equation Model I-A

For both models in all six categories, values of the residual covariance matrix ($S - \hat{\Sigma}$) are relatively small. For the SEM I-A for the Southeast, the average absolute residual for the unstandardized residual matrix is 0.0013, and the average off-diagonal absolute residual is 0.0013. For the standardized residual matrix, the average absolute standardized residual is 0.0819, and the average off-diagonal absolute residual is 0.0952. These results suggest that the model is reasonable for the data. Table 5.9 reports the goodness of fit summary for the SEM I-A. For each category (southeast, metro, urban 4 & 5, urban 6 & 7, and rural, coastal, and non-coastal), the independence model chi-squared statistics indicate that the observed variables are independent; therefore, there is no point of investigating the covariance structure or small sample size issues.

The chi-squared statistics (p_values are zero) for SEM I-A in all six categories provide a significance test that supports the hypothesis that the model fits the observed data. Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI are significantly close to one; RMR is almost zero. Lower Bentler-Bonnet NNFI (less than 0.80) is explained by an absolute value of correlation residuals having a value greater than 0.15. However, the other goodness of fit indices suggest that the model fits the data.

Table 5.9 The Goodness of Fit Index and Reliability Coefficient of the Structural Equation Model I-A

Summary Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	13549.407	4040.471	1010.969	4491.787	3066.516	3645.405	9909.661
Degrees of Freedom	37	38	38	39	38	37	37
Chi - Square	1118.753	707.945	100.292	788.376	3066.516	287.607	875.939
Degrees of Freedom	26	28	38	29	28.000	27	27
Probability value for the Chi-Square Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index	0.917	0.825	0.901	0.824	0.899	0.921	0.912
Bentler - Bonett Non-Normed Fit Index	0.885	0.769	0.899	0.771	0.873	0.901	0.882
Comparative Fit Index (CFI)	0.919	0.830	0.926	0.829	0.907	0.928	0.914
Bollen's (IFI) Fit Index	0.919	0.831	0.926	0.83	0.907	0.928	0.914
Root Mean-Square Residual (RMR)	0.003	0.005	0.004	0.004	0.006	0.004	0.003
Reliability Coefficients							
Cronbach's Alpha	0.592	0.625	0.682	0.584	0.558	0.664	0.696

Figure 5.70 illustrates the unstandardized regression results of the path analysis of the SEM I-A for the Southeast. Regression coefficient estimates of *EMPGRO, LNDENGRO* and *HOUS_00* have values of one. They are constrained to be 1 by the model.

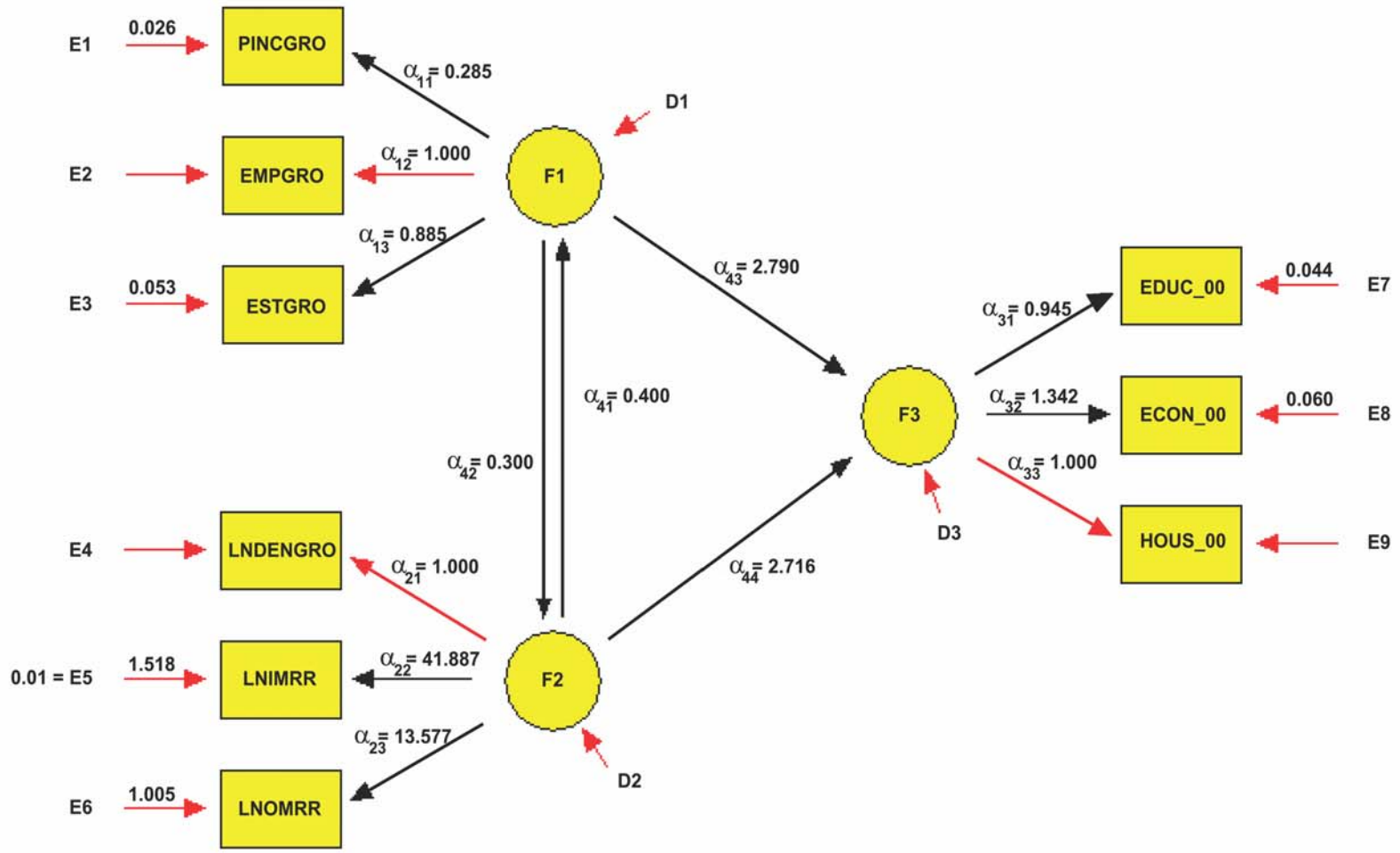

Figure 5.70 Unstandardized Regression Results for Structural Equation Model I-A for the Southeast

The ratio of the regression coefficient to the standard error is regarded as a test statistics for the null hypothesis that the given parameter is zero, and corresponding z-statistics is a range of 10.96.525 to 27.59; there is reason to reject null hypothesis. The variances of the error terms or residuals are estimated to be 0.000 for the economic growth factor. For the population growth factor, the coefficients are estimated as 0.000 for *LNDENGRO*, 0.046 for *LNOMRR*, and 0.010 for *LNIMRR*. For the 2000 social development factor, the regression coefficients are estimated as 0.000 for both *ECON_00* and *HOUS_00* and 0.007 for *EDUC_00*. In the case of the structural cause of the 2000 social development factor, the *D3*-independent disturbance term for F3 is 0.008. Since the variance of error terms are close to zero, this would suggest that the estimates are precise. Equation 5-4 represents the standardized solution for the Structural equation model I-A (SEM I-A) for the Southeast.

$$
\begin{aligned}
PINCGRO = V_1 &= 0.411 \cdot F_1 + 0.911 \cdot E_1 && R^2 = 0.169 \\
EMPGRO = V_2 &= 0.721 \cdot F_1 + 0692 \cdot E_2 && R^2 = 0.521 \\
ESTGRO = V_3 &= 0.678 \cdot F_1 + 0.735 \cdot E_3 && R^2 = 0.459 \\
LNDENGRO = V_4 &= 0.670 \cdot F_2 + 0.742 \cdot E_4 && R^2 = 0.449 \\
LNIMRR = V_5 &= 0.961 \cdot F_2 + 0.278 \cdot E_5 && R^2 = 0.923 \\
LNOMRR = V_6 &= 0.462 \cdot F_2 + 0.887 \cdot E_6 && R^2 = 0.214 \\
EDUC_00 = V_7 &= 0.781 \cdot F_3 + 0.625 \cdot E_7 && R^2 = 0.610 \\
ECON_00 = V_8 &= 0.819 \cdot F_3 + 0.573 \cdot E_8 && R^2 = 0.671 \\
HOUS_00 = V_9 &= 0.754 \cdot F_3 + 0.657 \cdot E_9 && R^2 = 0.568 \\
F_1 &= 0.197 \cdot F_2 + 0.869 \cdot D_1 && R^2 = 0.518 \\
F_2 &= 0.609 \cdot F_1 + 0.703 \cdot D_2 && R^2 = 0.518 \\
F_3 &= 0.418 \cdot F_1 + 0.201 \cdot F_2 + 0.815 \cdot D_3 && R^2 = 0.336
\end{aligned}
\qquad (5 - 4)
$$

Table 5.10 reports the results from the construct equations and standardized results section for the Structural equation model I-A (SEM I-A). Table 5.11 shows the decomposition of effects with the standardized values of SEM I-A.

Table 5.10 Standardized Regression Results for Structural Equation Model I – A

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.411	0.169	0.266	0.071	0.437	0.191	0.451	0.203	0.217	0.047	0.376	0.141	0.418	0.175
EMPGRO	*F1*	0.721	0.521	0.940	0.884	0.787	0.619	0.669	0.448	0.578	0.334	0.776	0.602	0.703	0.495
ESTGRO	*F1*	0.678	0.459	0.749	0.561	0.653	0.426	0.623	0.389	0.564	0.318	0.588	0.346	0.704	0.496
LN_DENGRO	*F2*	0.671	0.449	0.660	0.435	0.508	0.258	0.698	0.487	0.697	0.485	0.602	0.362	0.696	0.485
LN_IMRR	*F2*	0.961	0.923	0.957	0.915	0.968	0.938	0.951	0.905	0.963	0.928	0.969	0.938	0.957	0.916
LN_OMRR	*F2*	0.462	0.214	0.479	0.229	0.698	0.487	0.347	0.120	0.332	0.110	0.565	0.320	0.420	0.176
EDUC_00	*F3*	0.781	0.610	0.730	0.533	0.646	0.417	0.550	0.302	0.764	0.584	0.795	0.824	0.793	0.629
ECON_00	*F3*	0.819	0.671	0.756	0.572	0.728	0.530	0.831	0.690	0.904	0.818	0.908	0.513	0.790	0.624
HOUS_00	*F3*	0.754	0.568	0.560	0.314	0.866	0.750	0.744	0.554	0.949	0.900	0.716	0.643	0.810	0.657
F1	*F2*	0.197	0.518	0.221	0.465	0.140	0.794	0.190	0.538	0.215	0.476	0.163	0.643	0.211	0.484
F2	*F1*	0.609	0.518	0.543	0.465	0.858	0.794	0.631	0.538	0.557	0.476	0.734	0.380	0.568	0.484
F3	*F1*	0.418	0.336	-0.083	0.187	-0.017	0.168	0.318	0.194	0.152	0.060	0.735	0.380	0.267	0.284
	F2	0.201		0.485		0.425		0.150		0.115		-0.157		0.311	

Table 5.11 Decomposition of Standardized Effects for the Structural Equation Model I-A

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
PINCGRO	*F1*	0.467	0.056	0.411	0.302	0.036	0.266	0.497	0.060	0.437	0.512	0.061	0.451	0.247	0.030	0.217	0.427	0.051	0.376	0.475	0.057	0.418
	F2	0.092	0.092	0.000	0.067	0.067	0.000	0.069	0.069	0.000	0.097	0.097	0.000	0.053	0.053	0.000	0.070	0.070	0.000	0.100	0.100	0.000
EMPGRO	*F1*	0.820	0.098	0.722	1.068	0.128	0.940	0.894	0.107	0.787	0.760	0.091	0.669	0.657	0.079	0.578	0.882	0.106	0.776	0.799	0.096	0.703
	F2	0.162	0.162	0.000	0.236	0.236	0.000	0.125	0.125	0.000	0.145	0.145	0.000	0.141	0.141	0.000	0.144	0.144	0.000	0.169	0.169	0.000
ESTGRO	*F1*	0.770	0.092	0.678	0.851	0.102	0.749	0.742	0.089	0.653	0.708	0.085	0.623	0.641	0.077	0.564	0.668	0.080	0.588	0.800	0.096	0.704
	F2	0.152	0.152	0.000	0.188	0.188	0.000	0.104	0.104	0.000	0.135	0.135	0.000	0.138	0.138	0.000	0.109	0.109	0.000	0.169	0.169	0.000
LN_DENGRO	*F1*	0.464	0.464	0.000	0.407	0.407	0.000	0.495	0.495	0.000	0.501	0.501	0.000	0.441	0.441	0.000	0.502	0.502	0.000	0.449	0.449	0.000
	F2	0.762	0.091	0.671	0.750	0.090	0.660	0.577	0.069	0.508	0.793	0.095	0.698	0.792	0.095	0.697	0.684	0.082	0.602	0.791	0.095	0.696
LN_IMRR	*F1*	0.665	0.665	0.000	0.590	0.590	0.000	0.945	0.945	0.000	0.682	0.682	0.000	0.610	0.610	0.000	0.809	0.809	0.000	0.618	0.618	0.000
	F2	1.092	0.131	0.961	1.087	0.130	0.957	1.100	0.132	0.968	1.081	0.130	0.951	1.094	0.131	0.963	1.101	0.132	0.969	1.088	0.131	0.957
LN_OMRR	*F1*	0.320	0.320	0.000	0.295	0.295	0.000	0.681	0.681	0.000	0.249	0.249	0.000	0.210	0.210	0.000	0.472	0.472	0.000	0.271	0.271	0.000
	F2	0.525	0.063	0.462	0.544	0.065	0.479	0.793	0.095	0.698	0.394	0.047	0.347	0.377	0.045	0.332	0.642	0.077	0.565	0.477	0.057	0.420
EDUC_00	*F1*	0.480	0.480	0.000	0.149	0.149	0.000	0.255	0.255	0.000	0.258	0.258	0.000	0.187	0.187	0.000	0.560	0.560	0.000	0.400	0.400	0.000
	F2	0.251	0.251	0.000	0.387	0.387	0.000	0.310	0.310	0.000	0.132	0.132	0.000	0.128	0.128	0.000	-0.033	-0.033	0.000	0.331	0.331	0.000
	F3	0.781		0.781	0.730		0.730	0.646		0.646	0.550		0.550	0.764		0.764	0.795		0.795	0.793		0.793
ECON_00	*F1*	0.503	0.503	0.000	0.155	0.155	0.000	0.288	0.288	0.000	0.390	0.390	0.000	0.222	0.222	0.000	0.639	0.639	0.000	0.398	0.398	0.000
	F2	0.263	0.263	0.000	0.401	0.401	0.000	0.349	0.349	0.000	0.199	0.199	0.000	0.151	0.151	0.000	-0.038	-0.038	0.000	0.330	0.330	0.000
	F3	0.819		0.819	0.756		0.756	0.728		0.728	0.831		0.831	0.904		0.904	0.908		0.908	0.790		0.790
HOUS_00	*F1*	0.463	0.463	0.000	0.155	0.115	0.040	0.342	0.342	0.000	0.349	0.349	0.000	0.233	0.233	0.000	0.504	0.504	0.000	0.409	0.409	0.000
	F2	0.242	0.242	0.000	0.297	0.297	0.000	0.416	0.416	0.000	0.178	0.178	0.000	0.159	0.159	0.000	-0.030	-0.030	0.000	0.338	0.338	0.000
	F3	0.754		0.754	0.560		0.560	0.866		0.866	0.744		0.744	0.949		0.949	0.716		0.716	0.810		0.810
F1	*F1*	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	F2	0.224	0.027	0.197	0.251	0.030	0.221	0.159	0.019	0.140	0.216	0.026	0.190	0.244	0.029	0.215	0.185	0.022	0.163	0.240	0.029	0.211
F2	*F1*	0.692	0.083	0.609	0.617	0.074	0.543	0.975	0.117	0.858	0.717	0.086	0.631	0.633	0.076	0.557	0.834	0.100	0.734	0.645	0.077	0.568
	F2	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
F3	*F1*	0.614	0.196	0.418	0.205	0.288	-0.083	0.437	0.420	0.017	0.469	0.151	0.318	0.245	0.093	0.152	0.704	-0.031	0.735	0.504	0.237	0.267
	F2	0.322	0.121	0.201	0.531	0.045	0.486	0.480	0.055	0.425	0.239	0.089	0.150	0.168	0.053	0.115	-0.042	0.115	-0.157	0.418	0.107	0.311

Values of the direct effect with the standardized values are equal to values of the standardized regression results. The following conclusions are made based on the results of the structural equation model I–A (SEM I-A).

Economic growth factor (*F1*) effect on economic growth endogenous variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*):

1) Based on the results of decomposition effects with standardized values for SEM I-A for all categories, the economic growth factor (*F1*) has a positive direct and indirect effect on *PINCGRO*, *EMPGRO,* and *ESTGRO*. The total effects of the economic growth factor are strongest for the average annual rate of change in employment (*EMPGRO).* That is followed in declining order of strength by the average annual rate of change in the number of establishment (*ESTGRO)* and then by the average annual rate of change in per capita personal income (*PINCGRO*). These rankings are true for all six categories.
2) The effects of *F1* on *EMPGRO* for counties in MSAs, urban 4 & 5 counties, and coastal counties are higher than the effects of *F1* on *EMPGRO* for the overall Southeast. The effects of *F1* on *EMPGRO* for urban 6 & 7 counties, rural counties, and non-coastal counties are smaller than the effects of *F1* on *EMPGRO* for the overall Southeast.
3) The effects of *F1* on *ESTGRO* for counties in MSAs and non-coastal counties are higher than the effects of *F1* on *ESTGRO* for the overall Southeast. The effects of *F1* on *ESTGRO* for urban 4 & 5 counties, urban 6 & 7 counties, rural counties, and coastal counties is smaller than the effects of *F1* on *ESTGRO* for the overall Southeast.

4) The effects of *F1* on *PINCGRO* for urban 4 & 5 counties, urban 6 & 7 counties, and non-coastal counties are higher than the effects of *F1* on *PINCGRO* for the Southeast. The effects of *F1* on *PINCGRO* for counties in MSAs, rural counties, and coastal counties is smaller than the effects of *F1* on PINCGRO for the Southeast.

5) Comparing the indirect effects of the economic growth factors (*F1* through *F2*) on economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the indirect effects of *F1* on the average annual rate of change in employment (*EMPGRO)* is strongest. This is followed in strength by the average annual rate of change in number of establishment (*ESTGRO)* and the average annual rate of change in per capita personal income (*PINCGRO*) for all six categories.

6) Comparing the indirect effects of population growth factor (*F2* through *F1*) on economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the indirect effects of *F1* on the average annual rate of change in employment (*EMPGRO)* is strongest. This is followed in strength by the average annual rate of change in number of establishment (*ESTGRO)* and the average annual rate of change in per capita personal income (*PINCGRO*) for all six categories.

Population growth factor (*F2)* effect on population growth endogenous variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*):

7) The population growth factor (*F2*) has a positive direct and indirect effect on *LNDENGRO*, *LNIMRR,* and *LNOMRR* for all six categories. When comparing the factor loadings for the population growth factor, in-migration rate (*LNIMRR*) is the strongest, followed by the average annual rate of change in the population

density (*LNDENGRO*) and the out-migration rate (*LNOMRR*) for all categories except urban 4 & 5 counties.

8) The effects of *F2* on *LNDENGRO* for urban 6 & 7 counties, rural counties, and non-coastal counties are higher than the effects of *F2* on *LNDENGRO* for the overall Southeast. The effects of *F2* on *LNDENGRO* for counties in MSAs, urban 4 & 5 counties, and coastal counties are smaller than the effects of *F2* on *LNDENGRO* for the overall Southeast.

9) The effects of *F2* on *LNIMRR* for urban 4 & 5 counties, rural counties (slightly), and coastal counties are higher than the effects of *F1* on *LNIMRR* for the overall Southeast. The effects of *F2* on *LNIMRR* for counties in MSAs, urban 6 & 7 counties, and non-coastal counties are smaller than the effects of *F2* on *LNIMRR* for the overall Southeast.

10) The effects of *F2* on *LNOMRR* for counties in MSA, urban 4 & 5 counties, and coastal counties, are higher than the effects of *F2* on *LNOMRR* for the overall Southeast. The effects of *F2* on *LNOMRR* for urban 6 & 7 counties, rural counties, and non-coastal counties is smaller than the effects of *F2* on *LNOMRR* for the Southeast.

11) Comparing the indirect effects of population growth factor (*F2* through *F1*) on population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the indirect effect of *F2* on the in-migration rate (*LNIMRR*) is strongest, follwed by the effect of *F2* on the average annual rate of change in population density (*LNDENGRO*) and the out-migration rate (*LNOMRR*) for all categories except urban 4 & 5

counties. For urban 4 & 5 counties, the population growth factor has the strongest indirect effect on *LNIMRR*, then *LNOMRR*, and *LNDENGRO.*

12) Comparing the indirect effects of the economic growth factors (*F1* and *F2*) on population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the indirect effect of *F1* on the in-migration rate (*LNIMRR*) is strongest. This is followed by the strength of the effect of *F1* on the average annual rate of change in the population density (*LNDENGRO*) and on the out-migration rate (*LNOMRR*) for all categories except urban 4 & 5 counties. For urban 4 & 5 counties, the economic growth factor has strongest indirect effect on *LNIMRR*, then *LNOMRR*, and *LNDENGRO.*

2000 social development factor (*F3)* effect on the 2000 social development endogenous variables (*ECON_00*, *EDUC_00*, and *HOUS_00*):

13) The 2000 social development factor (*F3*) has a positive direct effect on *ECON_00*, *EDUC_00,* and *HOUS_00*. When comparing the factor loadings for the 2000 social development factor, the effect on the economic dimension opportunity index (*ECON_00*) is the strongest, followed by the effects on the education dimension index (*EDUC_00*) and housing dimension index (*HOUS_00*) for the Southeast, counties in MSAs, and coastal counties. For urban 4 & 5 counties and rural counties, the 2000 social development factor has the strongest effect on *HOUS_00*, followed by *ECON_00*, and *EDUC_00.* For urban 6 & 7 counties, the 2000 social development factor has the strongest effect on *ECON_00*, followed by *HOUS_00*, and *EDUC_00.* For non-coastal counties, the

2000 social development factor has the strongest effect on *HOUS_00*, followed by *ECON_00* and *EDUC_00.*

14) The effects of *F3* on *ECON_00* for urban 6 & 7 counties, rural counties, and coastal counties are higher than the effects of *F3* on *ECON_00* for the overall Southeast. The effects of *F3* on *ECON_00* for counties in MSAs, urban 4 & 5 counties, and non-coastal counties are smaller than the effects of *F3* on *ECON_00* for the overall Southeast.

15) The effects of *F3* on *EDUC_00* for coastal counties and non-coastal counties are higher than the effects of *F3* on *EDUC_00* for the overall Southeast. The effects of *F3* on *EDUC_00* for counties in MSAs, urban 6 & 7 counties, urban 4 & 5 counties, and rural counties are smaller than the effects of *F3* on *EDUC_00* for the overall Southeast.

16) The effects of *F3* on *HOUS_00* for urban 4 & 5 counties, rural counties, and non-coastal counties are higher than the effects of *F3* on *HOUS_00* for the overall Southeast; the effects of *F3* on *HOUS_00* for counties in MSA, urban 6 & 7 counties, and coastal counties are smaller than the effects of *F3* on *LNOMRR* for the overall Southeast.

17) Comparing the indirect effects of economic growth factor (*F1* through *F3*) and indirect effects of population growth (*F2* through *F3*) on *ECON_00*, *EDUC_00*, and *HOUS_00*, the indirect effects of economic growth factor on *ECON_00*, *EDUC_00*, and *HOUS_00* are stronger than the indirect effects of the population growth for the overall Southeast, urban 6 & 7 counties, rural counties, coastal counties, and non-coastal counties. The indirect effects of population growth on

ECON_00, *EDUC_00*, and *HOUS_00* are stronger than the indirect effects of economic growth on *ECON_00*, *EDUC_00*, and *HOUS_00* for counties in MSA and urban 4 & 5 counties.

18) Indirect effects of population growth on *ECON_00*, *EDUC_00*, and *HOUS_00* are negative for coastal counties.

Decomposition of causal effects:

19) The economic growth factor (*F1*) and population growth factor (*F2*) have positive interdependence relationships for the Southeast (in all six categories). In other words, an increase in the economic growth factor, in the 5 year time period, leads to an increase in the population growth for the Southeast. An increase in the population growth factor in the 5 year time period leads to an increase in the economic growth for the Southeast. However, the magnitude of the influence on each other is not the same. For the Southeast region in all six categories, the magnitude of impact of the economic growth on population growth is bigger than the magnitude of the population growth impact on economic growth. The indirect effect of economic growth factor on the economic growth variables and indirect effect of population growth on population growth variables is significant and positive.

20) The economic growth factor from 1995 to 2000 has significant and positive effects on the social development for the Southeast (in all six categories). This means an increase in the economic growth in the 5 year period. In the short run, the southeast region's overall well-being is improving. However, the direct effect of the economic growth from 1995 to 2000 has a significant negative effect on the

social development in 2000 for counties in MSAs. The indirect effect of the economic growth from 1995 to 2000 has a significant negative effect on the social development in 2000 for coastal counties.

21) Population growth from 1995 to 2000 has a significant positive effect on social development in 2000 for the Southeast (for all categories except coastal counties). This means an increase in population growth in the 5 year period, in the short run, will improve the well-being of the southeast region.

22) Comparing the urban and rural differences, the magnitude of the economic growth from 1995 to 2000 impact on the 2000 social development for urban 4 & 5 counties and urban 6 & 7 counties is bigger than the magnitude of economic growth from 1995 to 2000 impact on the 2000 social development for counties in MSA and rural counties. The magnitude of the population growth from 1995 to 2000 impact on the 2000 social development for counties in MSA and urban 4 & 5 counties is bigger than the magnitude of the population growth from 1995 to 2000 on 2000 social development for urban 6 & 7 counties and rural counties.

23) Comparing the coastal and non-coastal differences, the magnitude of the economic growth from 1995 to 2000 impact on the 2000 social development for coastal counties is greater than the magnitude of the economic growth from 1995 to 2000 impact on the 2000 social development for non-coastal counties. The magnitude of the population growth from 1995 to 2000 impact on the 2000 social development for non-coastal counties is bigger than the magnitude of the population growth from 1995 to 2000 impact on the 2000 social development for coastal counties.

24) The total effect of population growth from 1995 to 2000 has significant negative (because of strong negative direct effect) effects on the social development in 2000 for coastal counties of the Southeast. This means an increase in population growth in the 5 year period. In the short run, this produces a negative impact on the county's overall well-being. This result could be different for the long term period. Whether the region's social development or overall well-being is improving or not also depends on the rate of change of population growth and the economic growth. If the economy is growing at a faster rate than population growth, the society's overall well-being is better. If population growth is growing faster than the economic growth, society may experience an increase in poverty, unemployment, less housing opportunity, and a decrease in the quality of education. For coastal counties of the Southeast region, the magnitude of the impact of economic growth is greater than the magnitude of the population growth impact. So, the coastal counties' overall socio-economic well being is increasing, and the region seems to have sustainable socioeconomic development.

5.2.5 Findings from Full Structural Equation Model I -B

Results of the full structural equation model I-B (SEM I-B) are similar to those of the SEM I-A. Table 5.12 reports the goodness of fit index and reliability coefficient of the SEM I-B.

Table 5.12 The Goodness of Fit Index and Reliability Coefficient of the Structural Equation Model I-B

Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	13740.919	4186.399	1055.367	4538.665	3109.910	3688.332	10085.593
Degrees of Freedom	56	57	56	58	57	56	56
Chi - Square	1161.882	761.711	119.009	820.384	338.586	309.894	942.459
Degrees of Freedom	43	45	43	46.000	45.000	44	44
Probability value for the Chi-Square Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Indix (NFI)	0.915	0.818	0.887	0.819	0.891	0.916	0.907
Bentler - Bonett Non-Normed Fit Indix (NNFI)	0.894	0.780	0.901	0.782	0.878	0.907	0.886
Comparative Fit Index (CFI)	0.918	0.826	0.924	0.827	0.904	0.927	0.910
Bollen's (IFI) Fit Index	0.918	0.827	0.925	0.828	0.904	0.927	0.911
Root Mean-Square Residual (RMR)	0.002	0.004	0.002	0.003	0.005	0.003	0.002
Reliability Coefficients							
Cronbach's Alpha	0.696	0.641	0.689	0.595	0.549	0.672	0.702

From Table 5.12, the goodness of fit test for SEM I-B's chi-square statistics (p values are zero) for all six categories provides a significance test for the hypothesis that the model fits the observed data. The goodness of fit tests for SEM I-B are similar to the results of SEM I-A. The results for SEM I-B include values for Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI, that are close to one and an RMR that is almost zero. The lower Bentler-Bonnet NNFI (less than 0.80) is explained by the absolute value of correlation residuals having a value greater than 0.15. This suggests that there is a need to check the covariance structure of the residuals. The Cronbach's Alpha for SEM I-B is higher than for SEM I-A.

Table 5.13 reports the results from the construct equations and standardized results section of the SEM I-B output. Table 5.2.14 reports decomposition of effects with standardized values of SEM I-B.

Table 5.13 Standardized Regression Results for Structural Equation Model I-B

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.423	0.179	0.271	0.073	0.441	0.194	0.476	0.227	0.226	0.051	0.390	0.152	0.427	0.182
EMPGRO	*F1*	0.668	0.446	0.807	0.651	0.745	0.555	0.663	0.440	0.554	0.307	0.760	0.577	0.681	0.464
SESTGRO	*F1*	0.668	0.446	0.854	0.730	0.623	0.389	0.574	0.329	0.617	0.381	0.569	0.324	0.706	0.498
MESTGRO	*F1*	0.358	0.128	0.564	0.318	0.174	0.030	0.273	0.075	0.272	0.074	0.236	0.056	0.390	0.152
LESTGRO	*F1*	0.283	0.080	0.430	0.185	0.590	0.348	0.218	0.048	0.033	0.001	0.312	0.097	0.264	0.070
LN_DENGRO	*F2*	0.713	0.508	0.674	0.455	0.474	0.224	0.701	0.492	0.696	0.485	0.597	0.357	0.698	0.487
LN_IMRR	*F2*	0.963	0.928	0.957	0.916	0.968	0.937	0.952	0.906	0.963	0.928	0.969	0.938	0.957	0.916
LN_OMRR	*F2*	0.471	0.222	0.485	0.235	0.703	0.494	0.348	0.121	0.332	0.110	0.566	0.320	0.420	0.176
EDUC_00	*F3*	0.781	0.609	0.724	0.524	0.724	0.524	0.550	0.303	0.764	0.584	0.799	0.638	0.793	0.628
ECON_00	*F3*	0.826	0.682	0.776	0.602	0.715	0.511	0.831	0.691	0.904	0.818	0.905	0.819	0.791	0.625
HOUS_00	*F3*	0.755	0.570	0.557	0.310	0.680	0.463	0.745	0.555	0.949	0.900	0.722	0.521	0.811	0.658
F1	*F2*	0.743	0.652	0.267	0.409	0.134	0.847	0.195	0.525	0.224	0.460	0.165	0.636	0.219	0.468
F2	*F1*	0.161	0.652	0.450	0.409	0.897	0.847	0.617	0.525	0.536	0.460	0.729	0.636	0.547	0.468
F3	*F1*	0.537	0.379	0.065	0.183	0.109	0.392	0.327	0.199	0.148	0.060	0.762	0.395	0.283	0.287
	F2	0.094		0.384		0.524		0.148		0.118		-0.180		0.302	

Table 5.14 Decomposition of Standardized Effects for the Structural Equation Model I-B

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
PINCGRO	*F1*	0.481	0.058	0.423	0.308	0.037	0.271	0.501	0.060	0.441	0.541	0.065	0.476	0.257	0.031		0.443	0.053	0.390	0.485	0.058	0.427
	F2	0.357	0.357	0.000	0.082	0.082	0.000	0.067	0.067	0.000	0.105	0.105	0.000	0.058	0.058		0.073	0.073	0.000	0.106	0.106	0.000
EMPGRO	*F1*	0.759	0.091	0.668	0.917	0.110	0.807	0.847	0.102	0.745	0.753	0.090	0.663	0.630	0.076	0.554	0.864	0.104	0.760	0.774	0.093	0.681
	F2	0.564	0.564	0.000	0.245	0.245	0.000	0.113	0.113	0.000	0.147	0.147	0.000	0.141	0.141	0.000	0.142	0.142	0.000	0.170	0.170	0.000
SESTGRO	*F1*	0.759	0.091	0.668	0.970	0.116	0.854	0.708	0.085	0.623	0.652	0.078	0.574	0.701	0.084	0.617	0.647	0.078	0.569	0.802	0.096	0.706
	F2	0.564	0.564	0.000	0.259	0.259	0.000	0.095	0.095	0.000	0.127	0.127	0.000	0.157	0.157	0.000	0.106	0.106	0.000	0.176	0.176	0.000
MESTGRO	*F1*	0.407	0.049	0.358	0.641	0.077	0.564	0.198	0.024	0.174	0.310	0.037	0.273	0.309	0.037	0.272	0.268	0.032	0.236	0.443	0.053	0.390
	F2	0.302	0.302	0.000	0.171	0.171	0.000	0.026	0.026	0.000	0.060	0.060	0.000	0.069	0.069	0.000	0.044	0.044	0.000	0.097	0.097	0.000
LESTGRO	*F1*	0.321	0.039	0.282	0.489	0.059	0.430	0.670	0.08	0.590	0.248	0.030	0.218	0.037	0.004	0.033	0.355	0.043	0.312	0.300	0.036	0.264
	F2	0.239	0.239	0.000	0.130	0.130	0.000	0.090	0.09	0.000	0.048	0.048	0.000	0.008	0.008	0.000	0.058	0.058	0.000	0.066	0.007	0.059
LN_DENGRO	*F1*	0.131	0.131	0.000	0.345	0.345	0.000	0.483	0.483	0.000	0.492	0.492	0.000	0.424	0.424	0.000	0.495	0.495	0.000	0.434	0.434	0.000
	F2	0.810	0.097	0.713	0.766	0.092	0.674	0.539	0.065	0.474	0.797	0.096	0.701	0.791	0.095	0.696	0.678	0.081	0.597	0.793	0.095	0.698
LN_IMRR	*F1*	0.131	0.177	-0.046	0.489	0.489	0.000	0.987	0.987	0.000	0.667	0.667	0.000	0.587	0.587	0.000	0.802	0.802	0.000	0.595	0.595	0.000
	F2	1.095	0.131	0.964	1.087	0.130	0.957	1.100	0.132	0.968	1.082	0.130	0.952	1.095	0.131	0.964	1.101	0.132	0.969	1.088	0.131	0.957
LN_OMRR	*F1*	0.086	0.086	0.000	0.248	0.248	0.000	0.717	0.717	0.000	0.244	0.244	0.000	0.202	0.202	0.000	0.468	0.468	0.000	0.261	0.261	0.000
	F2	0.535	0.064	0.471	0.551	0.066	0.485	0.799	0.096	0.703	0.395	0.047	0.348	0.377	0.045	0.332	0.643	0.077	0.566	0.477	0.057	0.420
EDUC_00	*F1*	0.490	0.490	0.000	0.196	0.196	0.000	0.477	0.477	0.000	0.262	0.262	0.000	0.184	0.184	0.000	0.573	0.573	0.000	0.403	0.403	0.000
	F2	0.437	0.437	0.000	0.330	0.330	0.000	0.443	0.443	0.000	0.133	0.133	0.000	0.131	0.131	0.000	-0.049	-0.049	0.000	0.327	0.327	0.000
	F3	0.781		0.781	0.724		0.724	0.724		0.724	0.550		0.550	0.764		0.764	0.799		0.799	0.793		0.793
ECON_00	*F1*	0.518	0.518	0.000	0.210	0.210	0.000	0.471	0.471	0.000	0.396	0.396	0.000	0.217	0.217	0.000	0.649	0.649	0.000	0.402	0.402	0.000
	F2	0.462	0.462	0.000	0.354	0.354	0.000	0.438	0.438	0.000	0.200	0.200	0.000	0.155	0.155	0.000	-0.056	-0.056	0.000	0.327	0.327	0.000
	F3	0.826		0.826	0.776		0.776	0.715		0.715	0.831		0.831	0.904		0.904	0.905		0.905	0.791		0.791
HOUS_00	*F1*	0.474	0.474	0.000	0.150	0.150	0.000	0.448	0.448	0.000	0.355	0.355	0.000	0.228	0.228	0.000	0.518	0.518	0.000	0.413	0.413	0.000
	F2	0.423	0.423	0.000	0.254	0.254	0.000	0.416	0.416	0.000	0.179	0.179	0.000	0.163	0.163	0.000	-0.044	-0.044	0.000	0.335	0.335	0.000
	F3	0.755		0.755	0.557		0.557	0.680		0.680	0.745		0.745	0.949		0.949	0.722		0.722	0.811		0.811
F1	*F1*	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	F2	0.844	0.101	0.743	0.303	0.036	0.267	0.152	0.018	0.134	0.222	0.027	0.195	0.255	0.031	0.224	0.187	0.022	0.165	0.249	0.030	0.219
F2	*F1*	0.184	0.022	0.162	0.511	0.061	0.450	1.019	0.122	0.897	0.701	0.084	0.617	0.609	0.073	0.536	0.828	0.099	0.729	0.622	0.075	0.547
	F2	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
F3	*F1*	0.628	0.090	0.538	0.270	0.205	0.065	0.658	0.549	0.109	0.475	0.148	0.327	0.240	0.092	0.148	0.717	-0.045	0.762	0.509	0.226	0.283
	F2	0.560	0.466	0.094	0.456	0.072	0.384	0.612	0.088	0.524	0.241	0.093	0.148	0.172	0.054	0.118	-0.062	0.118	-0.180	0.414	0.112	0.302

The following conclusions for the establishment differences are made based the results of the SEM I-B.

The economic growth factor has the strongest effect on *SESTGRO*, then *MESTGRO,* and *LESTGRO* for the overall Southeast, counties in MSAs, urban 6 & 7 counties, rural counties, and non-coastal counties. This means that in those areas, economic growth seems to lead to the greatest increases in the number of small sized establishments and to a lesser extent, increase in the number of medium sized establishments and the number of large sized establishments. For the urban 4 & 5 counties and coastal counties, the economic growth factor has the strongest effect to *SESTGRO*, then *LESTGRO,* and *MESTGRO*. Urban 4 & 5 counties and coastal counties have the fastest growing large industries.

The population growth factor has the strongest effect on *SESTGRO*, followed by *MESTGRO,* and then *LESTGRO* for all categories except coastal counties. But the population growth factor has the strongest effect to *SESTGRO*, then *LESTGRO,* and *MESTGRO* for coastal counties. Thus, in both cases, the effect of population growth is positive for the growth rates of all size firms but has the greatest effect on the growth rate of small establishments.

5.2.6 Findings from Full Structural Equation Model II–A and II-B

Both simultaneous equation models SEM II-A and SEM II-B have the same exogenous variables: *MEDAGE*, *LNRACE, LNNATINC, ECON_90, EDUC_90, HOUS_90*, and *LNGRAV*. Results of the full structural equation model II-A (SEM II-A) are similar to the results for SEM II-B. Table 5.15 and Table 5.16 report the goodness of fit index and reliability coefficient of the SEM II-A and SEM II-B.

Table 5.15 The Goodness of Fit Index and Reliability Coefficient of the Structural Equation Model II-A

Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi- Square	23345.700	7229.310	1719.510	7357.654	4637.743	5885.555	17773.306
Degrees of Freedom	122	122	122	123	123	121	122
Chi - Square	5896.615	2209.616	536.792	2464.176	1262.300	1331.255	4829.252
Degrees of Freedom	70	70	70	72	71	69	70
Probability value for the Chi-Square Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index (NFI)	0.747	0.694	0.688	0.665	0.728	0.774	0.728
Bentler - Bonett Non-Normed Fit Index (NNFI)	0.563	0.475	0.491	0.435	0.543	0.616	0.530
Comparative Fit Index (CFI)	0.749	0.699	0.708	0.669	0.736	0.781	0.730
Bollen's (IFI) Fit Index	0.75	0.701	0.717	0.672	0.739	0.783	0.731
Root Mean-Square Residual (RMR)	0.023	0.035	0.048	0.015	0.013	0.032	0.021
Reliability Coefficients							
Cronbach's Alpha	0.226	0.125	0.628	0.692	0.626	0.037	0.368

Table 5.16 The Goodness of Fit Index and Reliability Coefficient of the Structural Equation Model II-B

Statistics	Southeast	Metro	Urban 4 & 5	Urban 6 & 7	Rural	Coastal	Non-Coastal
Goodness Fit Summary for Method ML							
Independence Model Chi-Square	16152.659	4877.656	1274.560	5318.402	3590.353	4373.965	1230.696
Degrees of Freedom	79	80	80	81	80	79	80
Chi - Square	1689.438	907.758	223.754	1033.790	488.750	449.717	1465.010
Degrees of Freedom	51	52	52	53	52	51	52
Probability value for the Chi-Square Statistics	0	0.000	0.000	0.000	0.000	0.000	0.000
Fit Indices							
Bentler - Bonett Normed Fit Index	0.895	0.814	0.824	0.806	0.864	0.897	0.881
Bentler - Bonett Non-Normed Fit Index	0.842	0.726	0.779	0.714	0.809	0.856	0.822
Comparative Fit Index (CFI)	0.898	0.822	0.856	0.813	0.876	0.907	0.884
Bollen's (IFI) Fit Index	0.898	0.823	0.860	0.814	0.877	0.908	0.885
Root Mean-Square Residual (RMR)	0.028	0.045	0.059	0.017	0.014	0.039	0.025
Reliability Coefficients							
Cronbach's Alpha	0.364	0.209	0.610	0.761	0.693	0.120	0.548

From Table 5.15 and Table 5.16, the goodness of fit test for both chi-square statistics of SEM II-A and SEM II-B for all six categories provide a significance test for the hypothesis that the model fits the observed data (p values are zero).

From Table 5.15 the goodness of fit summary of SEM II-A, the Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI, are below 0.80, as well as RMR being greater than 0.014. Lower fit indices are explained by the absolute value of correlation residuals having a value greater than 0.15, especially between social development level for 1990 and 2000. Therefore, the goodness of fit indices suggests that the model does not fit the data well. Some of the Cronbach's alpha for SEM II-A are also very low. Therefore, SEM I I-B is proposed.

Comparing the goodness of fit summary of SEM II-B to that of SEM II-A, the values of Bentler-Bonnet NFI, Bentler-Bonnet NNFI, CFI, and IFI are greater than 0.80

for SEM II-B. This is close to one, and RMR is practically zero, or less than 0.05, for SEM II-B. The lower Bentler-Bonnet NNFI (less than 0.80) is explained by the absolute value of correlation residuals having greater than 0.15 for SEM II-B for counties in metropolitan areas, urban 4 & 5 counties, and urban 6 & 7 counties.

Table 5.17 and Table 5.19 report the results from the construct equations and standardized results section of the SEM II-A output and SEM II-B respectively. Table 5.18 and Table 5.20 report decomposition of effects with standardized values of SEM II-A and SEM II-B respectively.

Table 5.17 Standardized Regression Results for Structural Equation Model II–A

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.393	0.154	0.272	0.074	0.455	0.207	0.448	0.200	0.250	0.063	0.316	0.100	0.407	0.165
EMPGRO	*F1*	0.694	0.482	0.897	0.805	0.774	0.599	0.640	0.410	0.562	0.316	0.795	0.632	0.659	0.435
ESTGRO	*F1*	0.704	0.495	0.801	0.641	0.723	0.522	0.660	0.436	0.621	0.386	0.586	0.343	0.735	0.540
LN_DENGRO	*F2*	0.703	0.494	0.711	0.506	0.354	0.126	0.696	0.484	0.691	0.478	0.636	0.404	0.736	0.542
LN_IMRR	*F2*	0.962	0.926	0.960	0.922	0.967	0.936	0.951	0.904	0.963	0.928	0.969	0.940	0.959	0.921
LN_OMRR	*F2*	0.466	0.217	0.498	0.248	0.708	0.501	0.344	0.119	0.337	0.114	0.564	0.318	0.423	0.179
EDUC_00	*F3*	0.854	0.729	0.733	0.538	0.797	0.635	0.577	0.333	0.695	0.483	0.870	0.756	0.859	0.737
ECON_00	*F3*	0.805	0.648	0.575	0.331	0.742	0.551	0.838	0.702	0.863	0.745	0.852	0.726	0.796	0.633
HOUS_00	*F3*	0.876	0.768	0.908	0.825	0.841	0.707	0.800	0.640	0.795	0.632	0.869	0.756	0.873	0.762
F1	*F2*	0.224	0.562	0.258	0.650	0.067	0.438	0.196	0.563	0.218	0.524	0.174	0.588	0.250	0.605
	MEDAGE	0.426		0.821		0.676		0.222		0.261		0.377		0.326	
	LN_NATINC	0.656		1.022		0.729		0.333		0.380		0.455		0.668	
	LN_RACE	-0.171		-0.030		0.026		-0.193		-0.179		-0.368		-0.216	
	ECON_90	0.117		0.046		0.143		0.158		-0.093		0.153		0.077	
	EDUC_90	-0.018		-0.168		0.065		0.152		-0.011		-0.021		-0.073	
	HOUS_90	-0.011		-0.040		0.105		0.077		0.312		0.043		0.017	
	LNGRAV	0.051		-0.139		0.218		0.225		0.212		-0.088		-0.054	
F2	*F1*	0.537	0.589	0.464	0.683	0.896	0.886	0.611	0.537	0.552	0.578	0.691	0.69	0.479	0.594
	MEDAGE	0.202		0.396		-0.438		0.104		0.326		0.180		0.134	
	LN_NATINC	0.197		0.501		-0.233		0.068		0.209		0.079		0.254	
	LN_RACE	0.099		-0.008		-0.337		0.097		0.298		-0.057		0.087	
	ECON_90	0.169		-0.003		0.03		0.158		0.238		-0.094		0.221	
	EDUC_90	0.12		0.337		0.233		-0.013		-0.096		0.250		0.044	
	HOUS_90	-0.174		-0.307		-0.188		-0.117		-0.148		-0.166		-0.112	
	LNGRAV	-0.003		0.094		-0.044		-0.087		-0.207		-0.043		-0.030	
F3	*F1*	0.054	0.698	0.100	0.788	0.124	0.585	0.169	0.438	0.084	0.418	0.085	0.733	0.052	0.687
	F2	0.101		0.039		0.075				0.104		0.085		0.115	
	MEDAGE	0.017		-0.062		-0.08		0.03		0.081		0.003		0.032	
	LN_NATINC	-0.007		-0.052		-0.103		-0.014		0.032		-0.037		-0.007	
	LN_RACE	-0.069		-0.054		-0.152		-0.094		-0.112		0.023		-0.067	
	ECON_90	0.243		0.141		0.142		0.373		0.361		0.297		0.234	
	EDUC_90	0.2618		0.180		0.286		0.123		0.14		0.288		0.277	
	HOUS_90	0.407		0.720		0.35		0.174		0.178		0.336		0.394	
	LNGRAV	0.013		-0.010		0.01		0.004		-0.017		0.032		-0.008	

Table 5.18 Decomposition of Standardized Effects for the Structural Equation Model II-A

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
PINCGRO	*F1*	0.447	0.054	0.393	0.309	0.037	0.272	0.484	0.029	0.455	0.509	0.061	0.448	0.284	0.034	0.250	0.359	0.043	0.316	0.462	0.055	0.407
	F2	0.100	0.100	0.000	0.080	0.08	0.000	0.032	0.032	0.000	0.100	0.100	0.000	0.062	0.062	0.000	0.062	0.062	0.000	0.116	0.116	0.000
	MEDAGE	0.211	0.211	0.000	0.286	0.286	0.000	0.313	0.313	0.000	0.123	0.123	0.000	0.094	0.094	0.000	0.146	0.146	0.000	0.166	0.166	0.000
	LN_NATINC	0.313	0.313	0.000	0.356	0.356	0.000	0.345	0.345	0.000	0.176	0.176	0.000	0.121	0.121	0.000	0.168	0.168	0.000	0.338	0.338	0.000
	LN_RACE	-0.066	-0.066	0.000	-0.010	-0.01	0.000	0.001	0.001	0.000	-0.088	-0.088	0.000	-0.032	-0.032	0.000	-0.135	-0.135	0.000	-0.090	-0.090	0.000
	ECON_90	0.069	0.069	0.000	0.014	0.014	0.000	0.070	0.070	0.000	0.096	0.096	0.000	-0.012	-0.012	0.000	0.049	0.049	0.000	0.061	0.061	0.000
	EDUC_90	0.004	0.004	0.000	-0.025	-0.025	0.000	0.039	0.039	0.000	0.076	0.076	0.000	-0.009	-0.009	0.000	0.008	0.008	0.000	-0.029	-0.029	0.000
	HOUS_90	-0.022	-0.022	0.000	-0.037	-0.037	0.000	0.044	0.044	0.000	0.027	0.027	0.000	0.080	0.080	0.000	0.005	0.005	0.000	-0.005	-0.005	0.000
	LNGRAV	-0.018	-0.018	0.000	-0.035	-0.035	0.000	0.104	0.104	0.000	0.105	0.105	0.000	0.047	0.047	0.000	-0.034	-0.034	0.000	-0.029	-0.029	0.000
EMPGRO	*F1*	0.789	0.095	0.694	1.019	0.122	0.897	0.823	0.049	0.774	0.727	0.087	0.640	0.639	0.077	0.562	0.903	0.108	0.795	0.749	0.090	0.659
	F2	0.176	0.176	0.000	0.264	0.264	0.000	0.055	0.055	0.000	0.143	0.143	0.000	0.139	0.139	0.000	0.157	0.157	0.000	0.188	0.188	0.000
	MEDAGE	0.372	0.372	0.000	0.942	0.942	0.000	0.533	0.533	0.000	0.176	0.176	0.000	0.212	0.212	0.000	0.369	0.369	0.000	0.270	0.270	0.000
	LN_NATINC	0.553	0.553	0.000	1.174	1.174	0.000	0.587	0.587	0.000	0.252	0.252	0.000	0.272	0.272	0.000	0.423	0.423	0.000	0.548	0.548	0.000
	LN_RACE	-0.117	-0.117	0.000	0.033	-0.033	0.066	0.002	0.002	0.000	-0.127	-0.127	0.000	-0.073	-0.073	0.000	-0.341	-0.341	0.000	-0.145	-0.145	0.000
	ECON_90	0.122	0.122	0.000	0.046	0.046	0.000	0.119	0.119	0.000	0.137	0.137	0.000	-0.026	-0.026	0.000	0.124	0.124	0.000	0.099	0.099	0.000
	EDUC_90	0.007	0.007	0.000	-0.083	-0.083	0.000	0.067	0.067	0.000	0.108	0.108	0.000	-0.020	-0.020	0.000	0.020	0.020	0.000	-0.047	-0.047	0.000
	HOUS_90	0.039	-0.039	0.078	-0.122	-0.122	0.000	0.076	0.076	0.000	0.039	0.039	0.000	0.179	0.179	0.000	0.013	0.013	0.000	-0.008	-0.008	0.000
	LNGRAV	-0.032	-0.032	0.000	-0.117	-0.117	0.000	0.177	0.177	0.000	0.151	0.151	0.000	0.106	0.106	0.000	-0.086	-0.086	0.000	-0.046	-0.046	0.000
ESTGRO	*F1*	0.800	0.096	0.704	0.910	0.109	0.801	0.769	0.046	0.723	0.750	0.090	0.660	0.706	0.085	0.621	0.666	0.080	0.586	0.835	0.100	0.735
	F2	0.179	0.179	0.000		0.235	-0.235	0.051	0.055	-0.004	0.147	0.147	0.000	0.153	0.153	0.000	0.115	0.115	0.000	0.209	0.209	0.000
	MEDAGE	0.377	0.377	0.000	0.840	0.840	0.000	0.497	0.533	-0.036	0.182	0.182	0.000	0.234	0.234	0.000	0.272	0.272	0.000	0.301	0.301	0.000
	LN_NATINC	0.560	0.560	0.000	1.048	1.048	0.000	0.548	0.587	-0.039	0.260	0.260	0.000	0.300	0.300	0.000	0.312	0.312	0.000	0.611	0.611	0.000
	LN_RACE	-0.119	-0.119	0.000	-0.029	-0.029	0.000	0.002	0.002	0.000	-0.131	-0.131	0.000	-0.080	-0.080	0.000	-0.251	-0.250	-0.001	-0.162	-0.162	0.000
	ECON_90	0.124	0.124	0.000	0.041	0.041	0.000	0.111	0.111	0.000	0.120	0.142	-0.022	-0.029	-0.029	0.000	0.091	0.091	0.000	0.110	0.110	0.000
	EDUC_90	0.007	0.007	0.000	-0.074	-0.074	0.000	0.062	0.062	0.000	0.112	0.112	0.000	-0.022	-0.022	0.000	0.015	0.015	0.000	-0.052	-0.052	0.000
	HOUS_90	-0.040	0.040	-0.080	-0.108	-0.108	0.000	0.071	0.071	0.000	0.040	0.040	0.000	0.197	0.197	0.000	0.010	0.010	0.000	-0.009	-0.009	0.000
	LNGRAV	-0.032	0.032	-0.064	-0.104	-0.104	0.000	0.165	0.165	0.000	0.156	0.156	0.000	0.118	0.118	0.000	-0.064	-0.064	0.000	-0.052	-0.052	0.000

Table 5.18 (continuous) Decomposition of Standardized Effects for the Structural Equation Model II–A

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
LN_DENGRO	*F1*	0.429	0.429	0.000	0.375	0.375	0.000	0.338	0.338	0.000	0.483	0.483	0.000	0.433	0.433	0.000	0.500	0.5	0.000	0.401	0.401	0.000
	F2	0.799	0.096	0.703	0.808	0.097	0.711	0.377	0.023	0.354	0.791	0.095	0.696	0.785	0.094	0.691	0.723	0.087	0.636	0.836	0.100	0.736
	MEDAGE	0.344	0.344	0.000	0.628	0.628	0.000	0.063	0.063	0.000	0.190	0.190	0.000	0.369	0.369	0.000	0.318	0.318	0.000	0.243	0.243	0.000
	LN_NATINC	0.439	0.439	0.000	0.789	0.789	0.000	0.158	0.158	0.000	0.215	0.215	0.000	0.329	0.329	0.000	0.284	0.284	0.000	0.480	0.480	0.000
	LN_RACE	0.006	0.006	0.000	-0.017	-0.017	0.000	-0.118	-0.118	0.000	-0.017	-0.017	0.000	0.156	0.156	0.000	-0.225	-0.225	0.000	-0.014	-0.014	0.000
	ECON_90	0.185	0.185	0.000	0.015	0.015	0.000	0.060	0.060	0.000	0.202	0.202	0.000	0.147	0.147	0.000	0.009	0.009	0.000	0.216	0.216	0.000
	EDUC_90	0.088	0.088	0.000	0.209	0.209	0.000	0.110	0.110	0.000	0.063	0.063	0.000	-0.080	-0.080	0.000	0.170	0.17	0.000	0.007	0.007	0.000
	HOUS_90	-0.144	-0.144	0.000	-0.263	-0.263	0.000	-0.036	-0.036	0.000	-0.055	-0.055	0.000	-0.019	0.019	-0.038	-0.099	-0.099	0.000	-0.087	-0.087	0.000
	LNGRAV	0.019	-0.019	0.038	0.024	0.024	0.000	0.057	0.057	0.000	0.040	0.040	0.000	-0.071	-0.071	0.000	-0.075	-0.075	0.000	-0.047	-0.047	0.000
LN_IMRR	*F1*	0.587	0.587	0.000	0.507	0.507	0.000	0.922	0.922	0.000	0.660	0.660	0.000	0.604	0.604	0.000	0.762	0.762	0.000	0.523	0.523	0.000
	F2	1.093	0.131	0.962	1.091	0.131	0.960	1.029	0.062	0.967	1.081	0.130	0.951	1.094	0.131	0.963	1.101	0.132	0.969	1.090	0.131	0.959
	MEDAGE	0.471	0.471	0.000	0.848	0.848	0.000	0.173	0.173	0.000	0.259	0.259	0.000	0.514	0.514	0.000	0.485	0.485	0.000	0.317	0.317	0.000
	LN_NATINC	0.601	0.601	0.000	1.065	1.065	0.000	0.432	0.432	0.000	0.293	0.293	0.000	0.458	0.458	0.000	0.433	0.433	0.000	0.626	0.626	0.000
	LN_RACE	0.008	0.008	0.000	-0.024	-0.024	0.000	-0.323	-0.323	0.000	-0.023	-0.023	0.000	0.218	0.218	0.000	-0.343	-0.343	0.000	-0.018	-0.018	0.000
	ECON_90	0.254	0.254	0.000	0.020	0.02	0.000	0.163	0.163	0.000	0.275	0.275	0.000	0.205	0.205	0.000	0.013	0.013	0.000	0.281	0.281	0.000
	EDUC_90	0.120	0.120	0.000	0.282	0.282	0.000	0.300	0.300	0.000	0.086	0.086	0.000	-0.112	-0.112	0.000	0.260	0.26	0.000	0.009	0.009	0.000
	HOUS_90	-0.197	-0.197	0.000	-0.355	-0.355	0.000	-0.097	-0.097	0.000	-0.075	-0.075	0.000	0.026	0.026	0.000	-0.150	-0.15	0.000	-0.113	-0.113	0.000
	LNGRAV	-0.026	-0.026	0.000	0.033	0.033	0.000	0.155	0.155	0.000	0.054	0.054	0.000	-0.099	-0.099	0.000	-0.115	-0.115	0.000	-0.061	-0.061	0.000
LN_OMRR	*F1*	0.284	0.284	0.000	0.263	0.263	0.000	0.675	0.675	0.000	0.239	0.239	0.000	0.211	0.211	0.000	0.443	0.443	0.000	0.231	0.231	0.000
	F2	0.530	0.064	0.466	0.566	0.068	0.498	0.753	0.045	0.708	0.391	0.047	0.344	0.383	0.046	0.337	0.641	0.077	0.564	0.481	0.058	0.423
	MEDAGE	0.228	0.228	0.000	0.440	0.44	0.000	0.127	0.127	0.000	0.094	0.094	0.000	0.180	0.180	0.000	0.282	0.282	0.000	0.140	0.140	0.000
	LN_NATINC	0.291	0.291	0.000	0.553	0.553	0.000	0.316	0.316	0.000	0.106	0.106	0.000	0.160	0.160	0.000	0.252	0.252	0.000	0.276	0.276	0.000
	LN_RACE	0.004	0.004	0.000	-0.012	-0.012	0.000	-0.236	-0.236	0.000	-0.008	-0.008	0.000	0.076	0.076	0.000	-0.200	-0.2	0.000	-0.008	-0.008	0.000
	ECON_90	0.123	0.123	0.000	0.011	0.011	0.000	0.119	0.119	0.000	0.100	0.100	0.000	0.072	0.072	0.000	0.008	0.008	0.000	0.124	0.124	0.000
	EDUC_90	0.058	0.058	0.000	0.146	0.146	0.000	0.219	0.219	0.000	0.031	0.031	0.000	-0.039	-0.039	0.000	0.151	0.151	0.000	0.004	0.004	0.000
	HOUS_90	-0.095	-0.095	0.000	-0.184	-0.184	0.000	-0.071	-0.071	0.000	-0.027	-0.027	0.000	0.009	0.009	0.000	-0.087	-0.087	0.000	-0.050	-0.050	0.000
	LNGRAV	-0.012	-0.012	0.000	0.017	0.017	0.000	0.113	0.113	0.000	0.020	0.020	0.000	-0.034	-0.034	0.000	-0.067	-0.067	0.000	-0.027	-0.027	0.000

Table 5.18 (continuous) Decomposition of Standardized Effects for the Structural Equation Model II–A

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
EDUC_00	*F1*	0.104	0.104	0.000	0.098	0.098	0.000	0.162	0.162	0.000	0.111	0.111	0.000	0.111	0.111	0.000	0.142	0.142	0.000	0.104	0.104	0.000
	F2	0.109	0.109	0.000	0.054	0.054	0.000	0.070	0.070	0.000	0.022	0.022	0.000	0.096	0.096	0.000	0.099	0.099	0.000	0.125	0.125	0.000
	F3	0.854		0.854	0.733		0.733	0.797		0.797	0.577		0.577	0.695		0.695	0.870		0.870	0.859		0.859
	MEDAGE	0.081	0.081	0.000	0.056	0.056	0.000	0.015	0.015	0.000	0.044	0.044	0.000	0.117	0.117	0.000	0.074	0.074	0.000	0.078	0.078	0.000
	LN_NATINC	0.084	0.084	0.000	0.089	0.089	0.000	0.020	0.020	0.000	0.030	0.030	0.000	0.085	0.085	0.000	0.039	0.039	0.000	0.095	0.095	0.000
	LN_RACE	-0.065	-0.065	0.000	-0.043	-0.043	0.000	-0.141	-0.141	0.000	-0.074	-0.074	0.000	-0.069	-0.069	0.000	-0.040	-0.040	0.000	-0.069	-0.069	0.000
	ECON_90	0.239	0.239	0.000	0.107	0.107	0.000	0.138	0.138	0.000	0.236	0.236	0.000	0.264	0.264	0.000	0.270	0.265	0.005	0.236	0.236	0.000
	EDUC_90	0.235	0.235	0.000	0.133	0.133	0.000	0.255	0.255	0.000	0.087	0.087	0.000	0.087	0.087	0.000	0.272	0.267	0.005	0.236	0.236	0.000
	HOUS_90	0.327	0.327	0.000	0.508	0.508	0.000	0.283	0.283	0.000	0.106	0.106	0.000	0.144	0.144	0.000	0.281	0.276	0.005	0.327	0.327	0.000
	LNGRAV	-0.007	-0.007	0.000	-0.016	-0.016	0.000	0.040	0.040	0.000	0.025	0.025	0.000	-0.008	-0.008	0.000	0.011	0.011	0.000	-0.016	-0.016	0.000
ECON_00	*F1*	0.098	0.104	-0.006	0.077	0.077	0.000	0.151	0.151	0.000	0.161	0.161	0.000	0.138	0.138	0.000	0.139	0.139	0.000	0.097	0.097	0.000
	F2	0.103	0.103	0.000	0.042	0.042	0.000	0.066	0.066	0.000	0.032	0.032	0.000	0.120	0.120	0.000	0.097	0.097	0.000	0.116	0.116	0.000
	F3	0.805		0.805	0.575		0.575	0.742		0.742	0.838		0.838	0.863		0.863	0.852		0.852	0.796		0.796
	MEDAGE	0.077	0.077	0.000	0.044	0.044	0.000	0.014	0.014	0.000	0.064	0.064	0.000	0.145	0.145	0.000	0.072	0.072	0.000	0.072	0.072	0.000
	LN_NATINC	0.079	0.079	0.000	0.070	0.07	0.000	0.019	0.019	0.000	0.044	0.044	0.000	0.105	0.105	0.000	0.038	0.038	0.000	0.088	0.088	0.000
	LN_RACE	-0.062	-0.062	0.000	-0.034	-0.034	0.000	-0.131	-0.131	0.000	-0.107	-0.107	0.000	-0.086	-0.086	0.000	-0.039	-0.039	0.000	-0.064	-0.064	0.000
	ECON_90	0.225	0.225	0.000	0.084	0.084	0.000	0.129	0.190	-0.061	0.343	0.343	0.000	0.327	0.327	0.000	0.265	0.265	0.000	0.219	0.219	0.000
	EDUC_90	0.221	0.221	0.000	0.105	0.105	0.000	0.237	0.237	0.000	0.127	0.127	0.000	0.108	0.108	0.000	0.267	0.267	0.000	0.218	0.218	0.000
	HOUS_90	0.308	0.308	0.000	0.399	0.399	0.000	0.263	0.263	0.000	0.154	0.154	0.000	0.179	0.179	0.000	0.276	0.276	0.000	0.303	0.303	0.000
	LNGRAV	-0.006	-0.006	0.000	-0.012	-0.012	0.000	0.037	0.037	0.000	0.037	0.037	0.000	0.010	-0.010	0.020	0.011	0.011	0.000	-0.015	-0.015	0.000
HOUS_00	*F1*	0.107	0.107	0.000	0.122	0.122	0.000	0.171	0.171	0.000	0.154	0.154	0.000	0.127	0.127	0.000	0.142	0.142	0.000	0.106	0.106	0.000
	F2	0.112	0.112	0.000	0.067	0.067	0.000	0.074	0.074	0.000	0.030	0.030	0.000	0.110	0.110	0.000	0.099	0.099	0.000	0.127	0.127	0.000
	F3	0.876		0.876	0.908		0.908	0.841		0.841	0.800		0.800	0.795		0.795	0.869		0.869	0.873		0.873
	MEDAGE	0.084	0.084	0.000	0.070	0.07	0.000	0.016	0.016	0.000	0.061	0.061	0.000	0.133	0.133	0.000	0.074	0.074	0.000	0.079	0.079	0.000
	LN_NATINC	0.086	0.086	0.000	0.111	0.111	0.000	0.021	0.021	0.000	0.042	0.042	0.000	0.097	0.097	0.000	0.039	0.039	0.000	0.097	0.097	0.000
	LN_RACE	-0.067	-0.067	0.000	-0.053	-0.053	0.000	-0.148	-0.148	0.000	-0.102	-0.102	0.000	-0.079	-0.079	0.000	-0.04	-0.04	0.000	-0.070	-0.070	0.000
	ECON_90	0.245	0.245	0.000	0.133	0.133	0.000	0.146	0.146	0.000	0.328	0.328	0.000	0.301	0.301	0.000	0.27	0.27	0.000	0.240	0.240	0.000
	EDUC_90	0.241	0.241	0.000	0.165	0.165	0.000	0.269	0.269	0.000	0.121	0.121	0.000	0.100	0.100	0.000	0.272	0.272	0.000	0.240	0.240	0.000
	HOUS_90	0.335	0.335	0.000	0.629	0.629	0.000	0.298	0.298	0.000	0.147	0.147	0.000	0.165	0.165	0.000	0.281	0.281	0.000	0.332	0.332	0.000
	LNGRAV	-0.007	-0.007	0.000	-0.020	-0.02	0.000	0.042	0.042	0.000	0.035	0.035	0.000	-0.010	-0.010	0.000	0.011	0.011	0.000	-0.017	-0.017	0.000

Table 5.18 (continuous) Decomposition of Standardized Effects for the Structural Equation Model II–A

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
F1	*F1*	0.136	0.136	0.000	0.136	0.136	0.000	0.064	0.064	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	F2	0.254	0.030	0.224	0.293	0.035	0.258	0.071	0.004	0.067	0.223	0.027	0.196	0.055	0.030	0.025	0.198	0.024	0.174	0.284	0.034	0.250
	MEDAGE	0.536	0.110	0.426	1.049	0.228	0.821	0.688	0.012	0.676	0.275	0.053	0.222	0.001	0.116	-0.115	0.464	0.087	0.377	0.409	0.083	0.326
	LN_NATINC	0.796	0.140	0.656	1.309	0.287	1.022	0.759	0.030	0.729	0.394	0.061	0.333	0.006	0.103	-0.097	0.532	0.077	0.455	0.831	0.163	0.668
	LN_RACE	-0.169	0.002	-0.171	-0.036	-0.006	-0.030	0.004	-0.022	0.026	-0.198	-0.005	-0.193	0.000	0.049	-0.049	-0.429	-0.061	-0.368	-0.221	-0.005	-0.216
	ECON_90	0.176	0.059	0.117	0.051	0.005	0.046	0.154	0.011	0.143	0.215	0.057	0.158	0.004	0.046	-0.042	0.155	0.002	0.153	0.150	0.073	0.077
	EDUC_90	0.010	0.028	-0.018	-0.092	0.076	-0.168	0.086	0.021	0.065	0.170	0.018	0.152	-0.005	-0.025	0.020	0.025	0.046	-0.021	-0.071	0.002	-0.073
	HOUS_90	-0.057	-0.046	-0.011	-0.136	-0.096	-0.040	0.098	-0.007	0.105	0.061	-0.016	0.077	0.002	0.006	-0.004	0.016	-0.027	0.043	-0.013	-0.030	0.017
	LNGRAV	0.045	-0.006	0.051	-0.130	0.009	-0.139	0.228	0.011	0.217	0.236	0.011	0.225	0.000	-0.022	0.022	-0.109	-0.021	-0.088	-0.070	-0.016	-0.054
F2	*F1*	0.610	0.073	0.537	0.527	0.063	0.464	0.953	0.057	0.896	0.694	0.083	0.611	0.041	0.075	-0.034	0.785	0.094	0.691	0.544	0.065	0.479
	F2	0.136	0.136	0.000	0.136	0.136	0.000	0.064	0.064	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	MEDAGE	0.490	0.288	0.202	0.883	0.487	0.396	0.179	0.617	-0.438	0.272	0.168	0.104	0.001	0.208	-0.207	0.501	0.321	0.180	0.330	0.196	0.134
	LN_NATINC	0.624	0.427	0.197	1.109	0.608	0.501	0.446	0.680	-0.234	0.309	0.241	0.068	0.009	0.267	-0.258	0.447	0.368	0.079	0.652	0.398	0.254
	LN_RACE	0.008	-0.091	0.099	-0.025	-0.017	-0.008	-0.334	0.003	-0.337	-0.024	-0.121	0.097	0.000	-0.072	0.072	-0.354	-0.297	-0.057	-0.019	-0.106	0.087
	ECON_90	0.264	0.095	0.169	0.021	0.024	-0.003	0.168	0.138	0.030	0.289	0.131	0.158	-0.001	-0.026	0.025	0.013	0.107	-0.094	0.293	0.072	0.221
	EDUC_90	0.125	0.005	0.120	0.294	-0.043	0.337	0.310	0.077	0.233	0.090	0.103	-0.013	-0.002	-0.020	0.018	0.267	0.017	0.250	0.010	-0.034	0.044
	HOUS_90	-0.204	-0.030	-0.174	-0.370	-0.063	-0.307	-0.100	0.088	-0.188	-0.080	0.037	-0.117	0.029	0.175	-0.146	-0.155	0.011	-0.166	-0.118	-0.006	-0.112
	LNGRAV	-0.027	-0.024	-0.003	0.034	-0.06	0.094	0.160	0.205	-0.045	0.057	0.144	-0.087	0.001	0.104	-0.103	-0.118	-0.075	-0.043	-0.064	-0.034	-0.030
F3	*F1*	0.122	0.068	0.054	0.134	0.034	0.100	0.203	0.079	0.124	0.192	0.023	0.169	0.664	0.076	0.588	0.164	0.079	0.085	0.121	0.065	0.056
	F2	0.128	0.027	0.101	0.074	0.035	0.039	0.088	0.014	0.074	0.038	0.038	0.000	0.556	0.035	0.521	0.113	0.028	0.085	0.145	0.136	0.009
	F3				0.000	0	0.000			0.000			0.000			0.000			0.000			0.000
	MEDAGE	0.095	0.078	0.017	0.077	0.139	-0.062	0.018	0.099	-0.081	0.077	0.047	0.030	0.004	0.089	-0.085	0.085	0.082	0.003	0.091	0.196	-0.105
	LN_NATINC	0.098	0.105	-0.007	0.122	0.174	-0.052	0.025	0.128	-0.103	0.053	0.067	-0.014	0.047	0.090	-0.043	0.046	0.083	-0.037	0.111	0.398	-0.287
	LN_RACE	-0.077	-0.008	-0.069	-0.059	-0.005	-0.054	-0.177	-0.025	-0.152	-0.127	-0.033	-0.094	0.001	0.013	-0.012	-0.044	-0.067	0.023	-0.081	-0.106	0.025
	ECON_90	0.279	0.036	0.243	0.147	0.006	0.141	0.173	0.032	0.141	0.409	0.036	0.373	0.015	0.018	-0.003	0.311	0.014	0.297	0.275	0.072	0.203
	EDUC_90	0.275	0.013	0.262	0.182	0.002	0.180	0.320	0.034	0.286	0.152	0.029	0.123	-0.023	-0.015	-0.008	0.313	0.025	0.288	0.274	-0.034	0.308
	HOUS_90	0.383	-0.024	0.407	0.692	-0.028	0.720	0.355	0.005	0.350	0.184	0.010	0.174	0.078	0.029	0.049	0.324	-0.012	0.336	0.380	-0.006	0.386
	LNGRAV	0.008	-0.005	0.013	-0.022	-0.012	-0.010	0.050	0.040	0.010	0.044	0.040	0.004	0.001	0.005	-0.004	0.013	-0.019	0.032	-0.019	-0.034	0.015

Table 5.19 Standardized Regression Results for Structural Equation Model II–B

Endogenous Variables	Exogenous Variables	Standardized Regression Results													
		Southeast		Metro		Urban 4 & 5		Urban 6 & 7		Rural		Coastal		Non Coastal	
		Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2	Coef.	R^2
PINCGRO	*F1*	0.396	0.157	0.272	0.074	0.465	0.217	0.447	0.200	0.269	0.072	0.327	0.107	0.411	0.169
EMPGRO	*F1*	0.694	0.481	0.887	0.787	0.764	0.584	0.650	0.423	0.550	0.303	0.782	0.612	0.659	0.434
ESTGRO	*F1*	0.704	0.496	0.804	0.646	0.705	0.497	0.655	0.428	0.605	0.366	0.596	0.355	0.733	0.538
LN_DENGRO	*F2*	0.701	0.491	0.726	0.527	0.435	0.189	0.695	0.484	0.695	0.483	0.636	0.404	0.734	0.538
LN_IMRR	*F2*	0.962	0.926	0.960	0.923	0.968	0.936	0.951	0.904	0.963	0.928	0.969	0.940	0.959	0.920
LN_OMRR	*F2*	0.466	0.217	0.491	0.241	0.703	0.495	0.346	0.120	0.340	0.115	0.563	0.317	0.426	0.181
EDUC_00	*F3*	0.791	0.625	0.738	0.544	0.823	0.678	0.514	0.264	0.765	0.585	0.845	0.715	0.780	0.608
ECON_00	*F3*	0.789	0.622	0.678	0.460	0.689	0.475	0.837	0.700	0.907	0.822	0.855	0.731	0.828	0.685
HOUS_00	*F3*	0.872	0.761	0.658	0.433	0.774	0.599	0.755	0.569	0.950	0.902	0.708	0.652	0.815	0.664
F1	*F2*	0.223	0.551	0.270	0.651	0.058	0.378	0.193	0.489	0.225	0.485	0.177	0.582	0.250	0.599
	MEDAGE	0.489		0.849		0.674		0.255		0.350		0.418		0.387	
	LN_NATINC	0.720		0.999		0.807		0.415		0.456		0.525		0.699	
	LN_RACE	-0.180		-0.04		-0.060		-0.225		-0.239		-0.427		-0.216	
	LNGRAV	-0.017		-0.200		0.171		0.227		0.189		-0.010		-0.039	
F2	*F1*	0.539	0.559	0.444	0.61	0.935	0.890	0.621	0.525	0.534	0.550	0.678	0.656	0.480	0.564
	MEDAGE	0.253		0.359		-0.518		0.164		0.45		0.133		0.231	
	LN_NATINC	0.294		0.574		-0.254		0.100		0.242		0.091		0.372	
	LN_RACE	0.092		-0.044		-0.338		0.101		0.355		-0.063		0.087	
	LNGRAV	-0.024		0.022		-0.089		-0.086		-0.165		0.101		-0.028	
F3	*F1*	0.118	0.512	-0.107	0.412	0.318	0.331	0.236	0.244	0.111	0.111	0.270	0.587	0.074	0.495
	F2	0.145		0.279		0.179		0.156		0.083		0.047		0.231	
	MEDAGE	0.118		0.307		-0.419		0.136		0.25		0.075		0.169	
	LN_NATINC	0.21		0.507		-0.232		0.094		0.187		0.219		0.233	
	LN_RACE	-0.131		-0.141		-0.287		-0.175		-0.081		0.422		-0.139	
	LNGRAV	0.493		0.438		-0.22		0.036		-0.071		0.537		0.430	

Table 5.20 Decomposition of Standardized Effects for the Structural Equation Model II–B

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
PINCGRO	*F1*	0.450	0.054	0.396	0.309	0.037	0.272	0.492	0.027	0.000	0.508	0.061	0.447	0.305	0.037	0.268	0.372	0.045	0.327	0.467	0.056	0.411
	F2	0.100	0.100	0.000	0.084	0.084	0.000	0.028	0.028	0.000	0.098	0.098	0.000	0.069	0.069	0.000	0.066	0.066	0.000	0.117	0.117	0.000
	MEDAGE	0.246	0.246	0.000	0.292	0.292	0.000	0.317	0.317	0.000	0.146	0.146	0.000	0.138	0.138	0.000	0.164	0.164	0.000	0.207	0.207	0.000
	LN_NATINC	0.354	0.354	0.000	0.357	0.357	0.000	0.390	0.390	0.000	0.221	0.221	0.000	0.156	0.156	0.000	0.201	0.201	0.000	0.369	0.369	0.000
	LN_RACE	-0.072	-0.072	0.000	-0.016	-0.016	0.000	-0.039	-0.039	0.000	-0.104	-0.104	0.000	-0.049	-0.049	0.000	-0.163	-0.163	0.000	-0.091	-0.091	0.000
	LNGRAV	-0.010	-0.010	0.000	-0.060	-0.060	0.000	0.082	0.082	0.000	0.107	0.107	0.000	0.046	0.046	0.000	-0.008	-0.008	0.000	-0.021	-0.021	0.000
EMPGRO	*F1*	0.789	0.095	0.694	1.008	0.121	0.887	0.808	0.044	0.764	0.739	0.089	0.650	0.625	0.075	0.550	0.889	0.107	0.782	0.749	0.090	0.659
	F2	0.175	0.175	0.000	0.273	0.273	0.000	0.047	0.047	0.000	0.143	0.143	0.000	0.141	0.141	0.000	0.157	0.157	0.000	0.187	0.187	0.000
	MEDAGE	0.430	0.430	0.000	0.954	0.954	0.000	0.521	0.521	0.000	0.212	0.212	0.000	0.282	0.282	0.000	0.393	0.393	0.000	0.333	0.333	0.000
	LN_NATINC	0.619	0.619	0.000	1.164	1.164	0.000	0.640	0.640	0.000	0.321	0.321	0.000	0.319	0.319	0.000	0.481	0.481	0.000	0.592	0.592	0.000
	LN_RACE	-0.126	-0.126	0.000	-0.052	-0.052	0.000	-0.064	-0.064	0.000	-0.152	-0.152	0.000	-0.100	-0.100	0.000	-0.390	-0.390	0.000	-0.145	-0.145	0.000
	LNGRAV	-0.017	-0.017	0.000	-0.196	0.196	-0.392	0.134	0.134	0.000	0.156	0.156	0.000	0.095	0.095	0.000	-0.020	-0.020	0.000	-0.034	-0.034	0.000
ESTGRO	*F1*	0.800	0.096	0.704	0.914	0.110	0.804	0.745	0.040	0.705	0.744	0.089	0.655	0.688	0.083	0.605	0.677	0.081	0.596	0.833	0.100	0.733
	F2	0.178	0.178	0.000	0.247	0.247	0.000	0.043	0.043	0.000	0.144	0.144	0.000	0.155	0.155	0.000	0.120	0.120	0.000	0.208	0.208	0.000
	MEDAGE	0.436	0.436	0.000	0.864	0.864	0.000	0.480	0.480	0.000	0.214	0.214	0.000	0.310	0.310	0.000	0.299	0.299	0.000	0.370	0.370	0.000
	LN_NATINC	0.628	0.628	0.000	1.054	1.054	0.000	0.590	0.590	0.000	0.323	0.323	0.000	0.351	0.351	0.000	0.366	0.366	0.000	0.659	0.659	0.000
	LN_RACE	-0.127	-0.127	0.000	-0.048	-0.048	0.000	-0.059	-0.059	0.000	-0.153	-0.153	0.000	-0.110	-0.110	0.000	-0.297	-0.297	0.000	-0.162	-0.162	0.000
	LNGRAV	-0.018	-0.018	0.000	-0.177	-0.177	0.000	0.124	0.124	0.000	0.157	0.157	0.000	0.104	0.104	0.000	-0.015	-0.015	0.000	-0.038	-0.038	0.000
LN_DENGRO	*F1*	0.429	0.429	0.000	0.366	0.366	0.000	0.429	0.429	0.000	0.491	0.491	0.000	0.422	0.422	0.000	0.490	0.490	0.000	0.401	0.401	0.000
	F2	0.797	0.096	0.701	0.825	0.099	0.726	0.460	0.025	0.435	0.790	0.095	0.695	0.790	0.095	0.695	0.723	0.087	0.636	0.834	0.100	0.734
	MEDAGE	0.411	0.411	0.000	0.607	0.607	0.000	0.052	0.052	0.000	0.255	0.255	0.000	0.503	0.503	0.000	0.301	0.301	0.000	0.347	0.347	0.000
	LN_NATINC	0.543	0.543	0.000	0.839	0.839	0.000	0.230	0.230	0.000	0.283	0.283	0.000	0.384	0.384	0.000	0.323	0.323	0.000	0.590	0.590	0.000
	LN_RACE	-0.004	-0.004	0.000	-0.051	-0.051	0.000	-0.181	-0.181	0.000	-0.030	-0.030	0.000	0.179	0.179	0.000	-0.255	-0.255	0.000	-0.014	-0.014	0.000
	LNGRAV	-0.026	-0.026	0.000	-0.055	-0.055	0.000	0.033	0.033	0.000	0.043	0.043	0.000	-0.051	-0.051	0.000	-0.053	-0.053	0.000	-0.039	-0.039	0.000
LN_IMRR	*F1*	0.589	0.589	0.000	0.484	0.484	0.000	0.956	0.956	0.000	0.671	0.671	0.000	0.585	0.585	0.000	0.747	0.747	0.000	0.524	0.524	0.000
	F2	1.093	0.131	0.962	1.091	0.131	0.960	1.023	0.055	0.968	1.081	0.130	0.951	1.095	0.131	0.964	1.101	0.132	0.969	1.090	0.131	0.959
	MEDAGE	0.564	0.564	0.000	0.803	0.803	0.000	0.115	0.115	0.000	0.348	0.348	0.000	0.697	0.697	0.000	0.459	0.459	0.000	0.454	0.454	0.000
	LN_NATINC	0.745	0.745	0.000	1.111	1.111	0.000	0.512	0.512	0.000	0.387	0.387	0.000	0.532	0.532	0.000	0.493	0.493	0.000	0.771	0.771	0.000
	LN_RACE	-0.006	-0.006	0.000	-0.067	-0.067	0.000	-0.403	-0.403	0.000	-0.041	-0.041	0.000	0.248	0.248	0.000	-0.389	-0.389	0.000	-0.019	-0.019	0.000
	LNGRAV	-0.036	-0.036	0.000	-0.073	-0.073	0.000	0.073	0.073	0.000	0.059	0.059	0.000	-0.070	-0.070	0.000	-0.081	-0.081	0.000	-0.051	-0.051	0.000
LN_OMRR	*F1*	0.286	0.286	0.000	0.248	0.248	0.000	0.695	0.695	0.000	0.244	0.244	0.000	0.206	0.206	0.000	0.434	0.434	0.000	0.233	0.233	0.000
	F2	0.530	0.064	0.466	0.558	0.067	0.491	0.743	0.040	0.703	0.393	0.047	0.346	0.386	0.046	0.340	0.640	0.077	0.563	0.484	0.058	0.426
	MEDAGE	0.274	0.274	0.000	0.411	0.411	0.000	0.083	0.083	0.000	0.127	0.127	0.000	0.246	0.246	0.000	0.267	0.267	0.000	0.201	0.201	0.000
	LN_NATINC	0.361	0.036	0.325	0.568	0.568	0.000	0.372	0.372	0.000	0.141	0.141	0.000	0.188	0.188	0.000	0.286	0.286	0.000	0.342	0.342	0.000
	LN_RACE	-0.003	-0.003	0.000	-0.034	-0.034	0.000	-0.293	-0.293	0.000	-0.015	-0.015	0.000	0.087	0.087	0.000	-0.226	-0.226	0.000	-0.008	-0.008	0.000
	LNGRAV	-0.017	-0.017	0.000	0.037	-0.037	0.074	0.053	0.053	0.000	0.022	0.022	0.000	-0.025	-0.025	0.000	-0.047	-0.047	0.000	-0.022	-0.022	0.000

Table 5.20 (Continuous) Decomposition of Standardized Effects for the Structural Equation Model II–B

Endogenous variables	Exogenous Variables	Southeast			Metro			Urban 4 & 5			Urban 6 & 7			Rural			Coastal			Noncoastal		
		Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct	Total	Indirect	Direct
EDUC_00	*F1*	0.177	0.177	0.000	0.014	0.014	0.000	0.422	0.422	0.000	0.194	0.194	0.000	0.135	0.135	0.000	0.290	0.290	0.000	0.164	0.164	0.000
	F2	0.154	0.154	0.000	0.210	0.210	0.000	0.171	0.171	0.000	0.117	0.117	0.000	0.094	0.094	0.000	0.091	0.091	0.000	0.221	0.221	0.000
	F3	0.791		0.791	0.738		0.738	0.823		0.823	0.514		0.514	0.765		0.765	0.845		0.845	0.780		0.780
	MEDAGE	0.219	0.219	0.000	0.314	0.314	0.000	-0.149	-0.149	0.000	0.139	0.139	0.000	0.333	0.281	0.052	0.196	0.196	0.000	0.246	0.246	0.000
	LN_NATINC	0.339	0.339	0.000	0.509	0.509	0.000	0.106	0.106	0.000	0.141	0.141	0.000	0.270	0.227	0.043	0.346	0.346	0.000	0.378	0.378	0.000
	LN_RACE	-0.121	-0.121	0.000	-0.114	-0.114	0.000	-0.320	-0.320	0.000	-0.122	-0.122	0.000	-0.072	-0.061	-0.011	-0.227	-0.227	0.000	-0.125	-0.125	0.000
	LNGRAV	0.396	0.396	0.000	0.325	0.325	0.000	-0.124	0.124	-0.248	0.052	0.052	0.000	-0.044	-0.044	0.000	0.445	0.445	0.000	0.323	0.323	0.000
ECON_00	*F1*	0.176	0.176	0.000	0.013	0.013	0.000	0.353	0.353	0.000	0.316	0.316	0.000	0.161	0.161	0.000	0.293	0.293	0.000	0.174	0.174	0.000
	F2	0.154	0.154	0.000	0.193	0.193	0.000	0.143	0.143	0.000	0.191	0.191	0.000	0.112	0.112	0.000	0.092	0.092	0.000	0.235	0.235	0.000
	F3	0.789		0.789	0.678		0.678	0.689		0.689	0.837		0.837	0.907		0.907	0.855		0.855	0.828		0.828
	MEDAGE	0.218	0.218	0.000	0.289	0.289	0.000	-0.125	-0.125	0.000	0.226	0.226	0.000	0.333	0.333	0.000	0.199	0.199	0.000	0.261	0.261	0.000
	LN_NATINC	0.338	0.338	0.000	0.468	0.468	0.000	0.089	0.089	0.000	0.229	0.229	0.000	0.270	0.270	0.000	0.350	0.350	0.000	0.401	0.401	0.000
	LN_RACE	-0.121	-0.121	0.000	-0.105	-0.105	0.000	-0.268	-0.268	0.000	-0.198	-0.198	0.000	-0.072	-0.072	0.000	-0.230	-0.230	0.000	-0.133	-0.133	0.000
	LNGRAV	0.395	0.395	0.000	0.299	0.299	0.000	-0.104	-0.104	0.000	0.085	0.085	0.000	-0.052	-0.052	0.000	0.450	0.450	0.000	0.342	0.342	0.000
HOUS_00	*F1*	0.195	0.195	0.000	0.013	0.130	-0.117	0.397	0.397	0.000	0.285	0.285	0.000	0.168	0.168	0.000	0.277	0.277	0.000	0.172	0.172	0.000
	F2	0.170	0.170	0.000	0.187	0.187	0.000	0.161	0.161	0.000	0.173	0.173	0.000	0.117	0.117	0.000	0.087	0.087	0.000	0.231	0.231	0.000
	F3	0.872		0.872	0.658		0.658	0.774		0.774	0.755		0.755	950.000		950.000	0.808		0.808	0.815		0.815
	MEDAGE	0.242	0.242	0.000	0.280	0.280	0.000	-0.140	-0.140	0.000	0.204	0.204	0.000	0.349	0.349	0.000	0.188	0.188	0.000	0.257	0.257	0.000
	LN_NATINC	0.373	0.373	0.000	0.454	0.454	0.000	0.100	0.100	0.000	0.207	0.207	0.000	0.282	0.282	0.000	0.330	0.330	0.000	0.395	0.395	0.000
	LN_RACE	-0.133	-0.133	0.000	-0.102	-0.102	0.000	-0.301	-0.301	0.000	-0.179	-0.179	0.000	-0.076	-0.076	0.000	-0.218	-0.217	-0.001	-0.131	-0.131	0.000
	LNGRAV	0.437	0.437	0.000	0.290	0.290	0.000	-0.116	-0.116	0.000	0.077	0.077	0.000	-0.055	-0.055	0.000	0.425	0.425	0.000	0.337	0.337	0.000
F1	*F1*	0.136	0.136	0.000	0.136	0.136	0.000	0.057	0.057	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	F2	0.253	0.030	0.223	0.307	0.037	0.270	0.061	0.003	0.058	0.219	0.026	0.193	0.256	0.031	0.225	0.201	0.024	0.177	0.284	0.034	0.250
	MEDAGE	0.620	0.131	0.489	1.076	0.226	0.850	0.681	0.007	0.674	0.326	0.071	0.255	0.513	0.163	0.350	0.502	0.084	0.418	0.505	0.118	0.387
	LN_NATINC	0.892	0.172	0.720	1.312	0.313	0.999	0.838	0.031	0.807	0.494	0.079	0.415	0.580	0.124	0.456	0.615	0.090	0.525	0.900	0.201	0.699
	LN_RACE	-0.181	-0.001	-0.180	-0.059	-0.019	-0.040	-0.084	-0.024	-0.060	-0.233	-0.008	-0.225	-0.181	0.058	-0.239	-0.498	-0.071	-0.427	-0.221	-0.005	-0.216
	LNGRAV	-0.025	-0.008	-0.017	-0.220	-0.020	-0.200	0.175	0.004	0.171	0.239	0.012	0.227	0.173	-0.016	0.189	-0.025	-0.015	-0.010	-0.052	-0.013	-0.039
F2	*F1*	0.613	0.074	0.539	0.505	0.061	0.444	0.988	0.053	0.935	0.706	0.085	0.621	0.607	0.073	0.534	0.770	0.092	0.678	0.546	0.066	0.480
	F2	0.136	0.136	0.000	0.136	0.136	0.000	0.057	0.057	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000	0.136	0.136	0.000
	MEDAGE	0.587	0.334	0.253	0.836	0.477	0.359	0.119	0.637	-0.518	0.366	0.202	0.164	0.724	0.274	0.450	0.474	0.341	0.133	0.474	0.243	0.231
	LN_NATINC	0.775	0.481	0.294	1.157	0.582	0.575	0.529	0.783	-0.254	0.406	0.306	0.100	0.552	0.310	0.242	0.508	0.417	0.091	0.804	0.432	0.372
	LN_RACE	-0.006	-0.098	0.092	-0.070	-0.026	-0.044	-0.417	-0.079	-0.338	-0.044	-0.145	0.101	0.258	-0.097	0.355	-0.401	-0.338	-0.063	-0.019	-0.106	0.087
	LNGRAV	-0.037	-0.013	-0.024	-0.076	-0.098	0.022	0.075	0.164	-0.089	0.063	0.149	-0.086	-0.073	0.092	-0.165	0.084	-0.017	0.101	-0.053	-0.025	-0.028
F3	*F1*	0.223	0.105	0.118	0.019	0.126	-0.107	0.513	0.195	0.318	0.378	0.142	0.236	0.177	0.066	0.111	0.343	0.073	0.270	0.210	0.136	0.074
	F2	0.195	0.050	0.145	0.284	0.005	0.279	0.208	0.030	0.178	0.229	0.073	0.156	0.123	0.040	0.083	0.108	0.061	0.047	0.284	0.053	0.231
	F3			0.118	0.000	0.000	0.000			0.000			0.000			0.000			0.000			0.000
	MEDAGE	0.277	0.159		0.426	0.119	0.307	-0.181	0.238	-0.419	0.270	0.134	0.136	0.368	0.118	0.250	0.233	0.158	0.075	0.316	0.147	0.169
	LN_NATINC	0.428	0.218	0.210	0.689	0.183	0.506	0.129	0.361	-0.232	0.274	0.180	0.094	0.298	0.111	0.187	0.409	0.190	0.219	0.485	0.252	0.233
	LN_RACE	-0.153	-0.022	-0.131	-0.154	-0.013	-0.141	-0.388	-0.101	-0.287	-0.237	-0.062	-0.175	-0.080	0.001	-0.081	0.269	-0.153	0.422	-0.160	-0.021	-0.139
	LNGRAV	0.501	0.008	0.493	0.440	0.002	0.438	-0.150	0.069	-0.219	0.102	0.066	0.036	-0.058	0.013	-0.071	0.526	-0.011	0.537	0.414	-0.016	0.430

SEM II-The Model II B results suggested that:

1) Median age (*MEDAGE*) has a positive effect on the economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the 2000 social development growth variables (*ECON_00, EDUC_00*, and *HOUS_OO*), the economic growth factor (*F1*), the population growth factor (*F2*), and the 2000 social development factor (*F3*) for all categories except in one case. *MEDAGE* has a negative effect on the 2000 social development variables (*ECON_00, EDUC_00*, and *HOUS_OO*) for urban 4 & 5.
2) The ratio of the number of births to the number of deaths (*LNNATINC*) has a positive effect on the economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the 2000 social development growth (*ECON_00, EDUC_00*, and *HOUS_OO*), the economic growth factor (*F1*), the population growth factor (*F2*), and the 2000 social development factor (*F3*) for all categories.
3) The ratio of the number of non-whites to number of whites (*LNRACE*) has a negative effect on the economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the 2000 social development growth (*ECON_00, EDUC_00*, and *HOUS_OO*), economic growth factor (*F1*), population growth factor (*F2*), and the 2000 social development factor (*F3*) for all categories. There are some exceptions in the following cases. *LNRACE* has a positive effect on the population growth variables (*LNDENGRO, LNIMRR*, and *LNOMRR*) and the population

growth factor (*F2*) for rural counties. *LNRACE* has a positive effect on the 2000 social development (*F3*) for coastal counties.

4) Gravity of large cities (*LNGRAV*) has a negative effect on the economic growth variables (*PINCGRO*, *EMPGRO*, and *ESTGRO*), the population growth variables (*LNDENGRO*, *LNIMRR*, and *LNOMRR*), the economic growth factor (*F1*), and the population growth factor (*F2*) for the Southeast, counties in MSAs, and coastal and non-coastal counties. There is one exception to the case. *LNGRAV* has a positive total effect on the population growth factor (*F2*) for coastal counties. *LNGRAV* has a positive total effect on all economic growth variables and factor, the population growth variables and factor, and the 2000 social development variables and factor for urban 6 & 7 counties. *LNGRAV* has a positive total effect on all the economic growth variables and factor, and the population growth variables and factor. *LNGRAV* has a negative total effect on all 2000 social development variables and factor for urban 4 & 5 counties.

Although the 1990 social development variables are included in SEM II-A, the model's goodness of fit indices suggests that the model does not fit the data. Therefore, the output is not discussed; however, SEM II-A is reported in Table 5.2.17 and Table 5.2.18, which is provided.

5.2.7 Summary for Findings of the Measurement Models and SEMs

The following sections have been reviewed and discussed:

1) The results of the measurements models for factors of economic growth, population growth, and the 2000 social development.
2) The results of four types of structural equation models.

Based on the results, the economic growth factor is explained by employment growth in the majority of cases. The population growth factor is usually explained by the in-migration rate or the average annual rate of change in population density. The housing dimension index and economic opportunity dimension index are normally explained by the 2000 social development factor. The explanation of the population growth factor or the 2000 social development factor depends on rural/urban differences and coastal and non-coastal differences.

The economic growth factor and the population growth factor have an interdependence relationship. The effect of the population growth factor on the economic growth factor is weaker than the effect of the economic growth factor on the population growth factor.

Economic growth and population growth have positive effects on the 2000 social development factor for the Southeast.

The effects of exogenous variables, such as *MEDAGE*, *LNRACE*, *LNNATINC*, and LNGRAV, have significant effects on factors of economic growth, population growth, and the 2000 social development.

Results of the SEM I and SEM II models suggest signs of each individual coefficient validate with each proposed hypothesis.

5.3 GIS Raster Models

This section provides the results of the structural equation modeling mapped into the GIS raster model form. The following maps provide an illustration of the southeast region of the United States in which the actual constructs are plotted versus the predicted constructs from GIS raster model based on the SEM II-B model. The economic growth factor constructs are: *PINCGRO*, *EMPGRO*, and *ESTGRO*; the population growth factor constructs are: *LNDENGRO*, *LNIMRR*, and *LNOMRR*; and the social development factor constructs are: *ECON_00*, *EDUC_00*. The actual measurement models results for factors are also plotted versus the predicted factors, based on the SEM II Model for the economic growth factor (*F1*), the population growth factor (*F2*), and the social development factor (*F3*).

Figure 5.71 illustrates the actual *PINCGRO* (average annual rate of change in real per capita personal income from 1995 to 2000) versus the predicted *PINCGRO* from the GIS raster model for the entire southeastern United States. The overall map correlation between the actual *PINCGRO* and the predicted *PINCGRO* is very strong. As a whole, the eastern and northeastern areas of the southeast region had the highest *PINCGRO*, which was the case for the predicted *PINCGRO*. The areas of Arkansas and Louisiana and the western areas of the region had both the lowest actual and predicted *PINCGRO*.

Figure 5.72 illustrates the actual *EMPGRO* (average annual rate of change in total number of people employed from 1995 to 2000) versus the predicted *EMPGRO* from the GIS raster model for the entire southeastern United States. Based on this map, the overall map correlation was very strong between the actual and predicted *EMPGRO*. The eastern and southeastern areas of the region had the highest actual and predicted *EMPGRO*. The

eastern areas of Louisiana and Arkansas and western Alabama had the highest actual and predicted *EMPGRO.*

Figure 5.73 shows the actual *ESTGRO* (average annual rate of change in total number of establishments from 1995 to 2000) versus the predicted *ESTGRO* from the GIS raster model for the entire southeastern United States. The actual *ESTGRO* versus the predicted *ESTGRO* had good accuracy for the lowest *ESTGRO* areas; however, accuracy was not very high for the highest *ESTGRO* areas. The correlation between actual and predicted *ESTGRO* was much weaker for the state of Tennessee and the Atlanta areas, while for northern Florida, the relationship between actual and predicted *ESTGRO* was particularly strong.

Figure 5.74 shows the results for the actual and predicted *LNDENGRO* (natural logarithm of average annual rate of change in population density from 1995 to 2000). The overall predictions were accurate. The only concerns would be for the states of Arkansas and Louisiana, where the predicted and actual values for the lowest *LNDENGRO* did not correlate well.

Figure 5.75 shows the actual *LNIMRR* (natural logarithm of in-migration rate from 1995 to 2000) versus the predicted *LNIMRR* from the GIS raster model for the entire southeastern United States. The correlation between the two maps for *LNIMRR* showed fairly substantial accuracy. In the Atlanta area and the coastal areas (with the highest *LNIMRRs*), the prediction map was very similar to the map of the actual *LNIMRR*. The relationship between actual and predicted maps for the lowest *LNIMRR* was close in Kentucky. Overall, the map illustrates that the predictions for *LNIMRR* were accurate, especially in areas where heavy population and economic growth is significant.

Figure 5.76 shows the actual *LNOMRR* (natural logarithm of out-migration rate from 1995 to 2000) versus the predicted *LNOMRR* from the GIS raster model for the entire southeastern United States. The mapping indicates that the predicted *LNOMRRs* were relatively accurate.

Figures 5.77, 5.78, and 5.79 show the mapping of actual and predicted social development variables *ECON_00*, *EDUC_00*, and *HOUS_00*. The mapping shows that the predicted variables were relatively accurate.

Figure 5.80 shows the predicted and actual *F1* from the economic growth measurement model. Lowest *F1* factors do not seem to have been predicted well, but when coupled with the lower *F1* areas, there is more accuracy.

Figure 5.81 shows the predicted *F2* from population growth measurement model versus *F2* from the raster model; however, the maps did not illustrate a well match. On the other hand, as shown in Figure 5.82, the predicted versus actual *F3* from the social development measurement model versus *F3* correlated very well, producing significant matches in the maps.

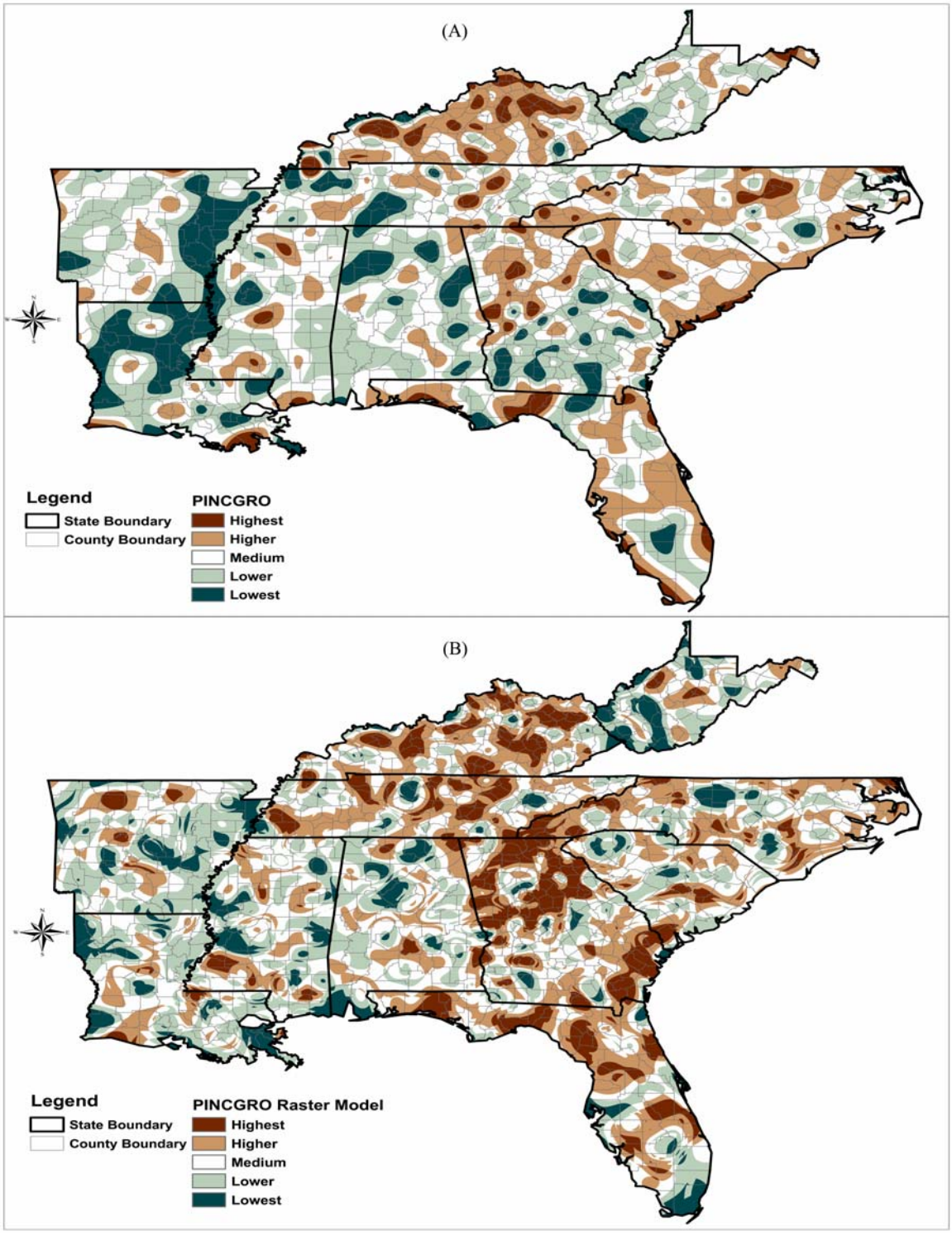

Figure 5.71 Actual *PINCGRO* vs. Predicted *PINCGRO* from GIS Raster Model

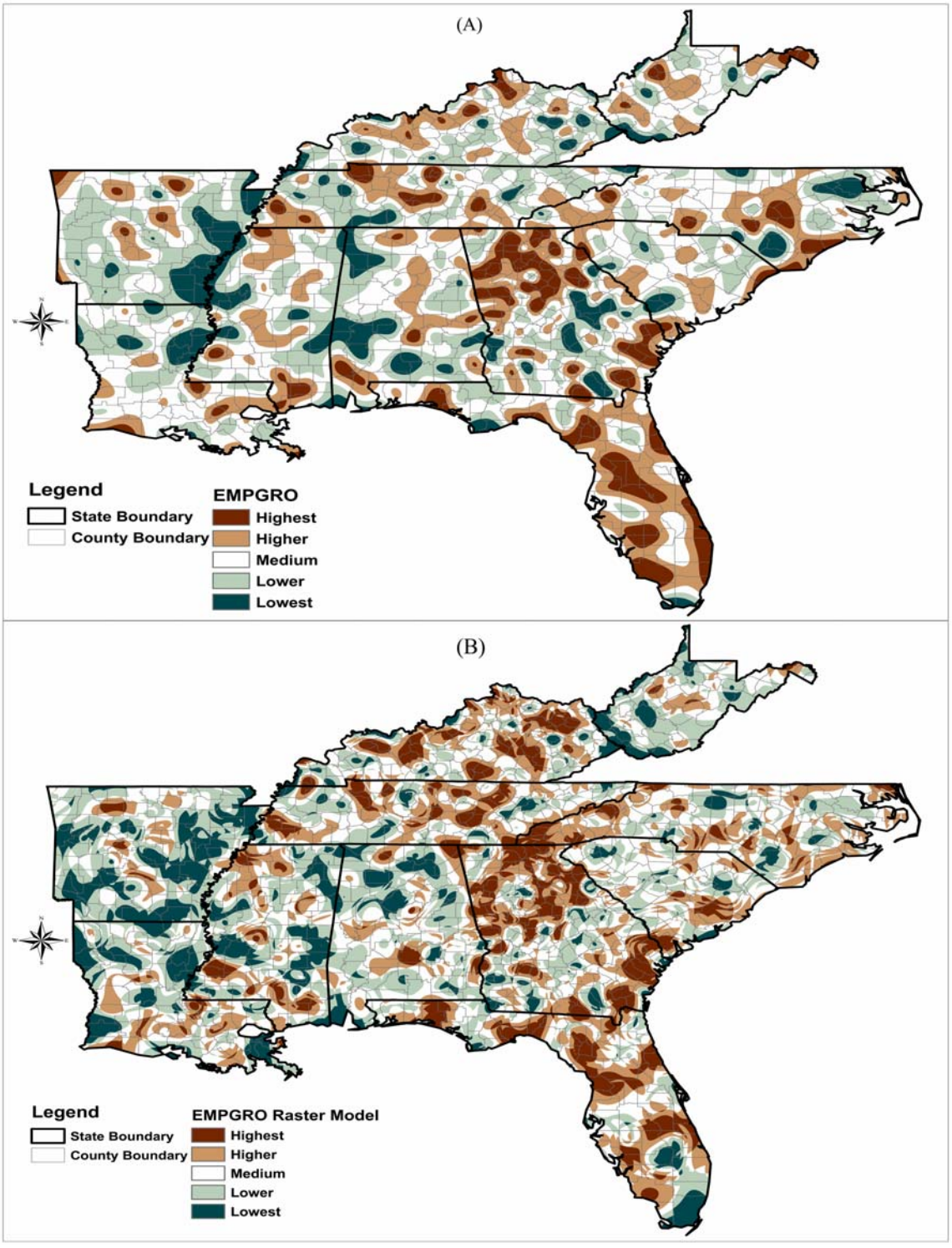

Figure 5.72 Actual *EMPGRO* vs. Predicted *EMPGRO* from GIS Raster Model

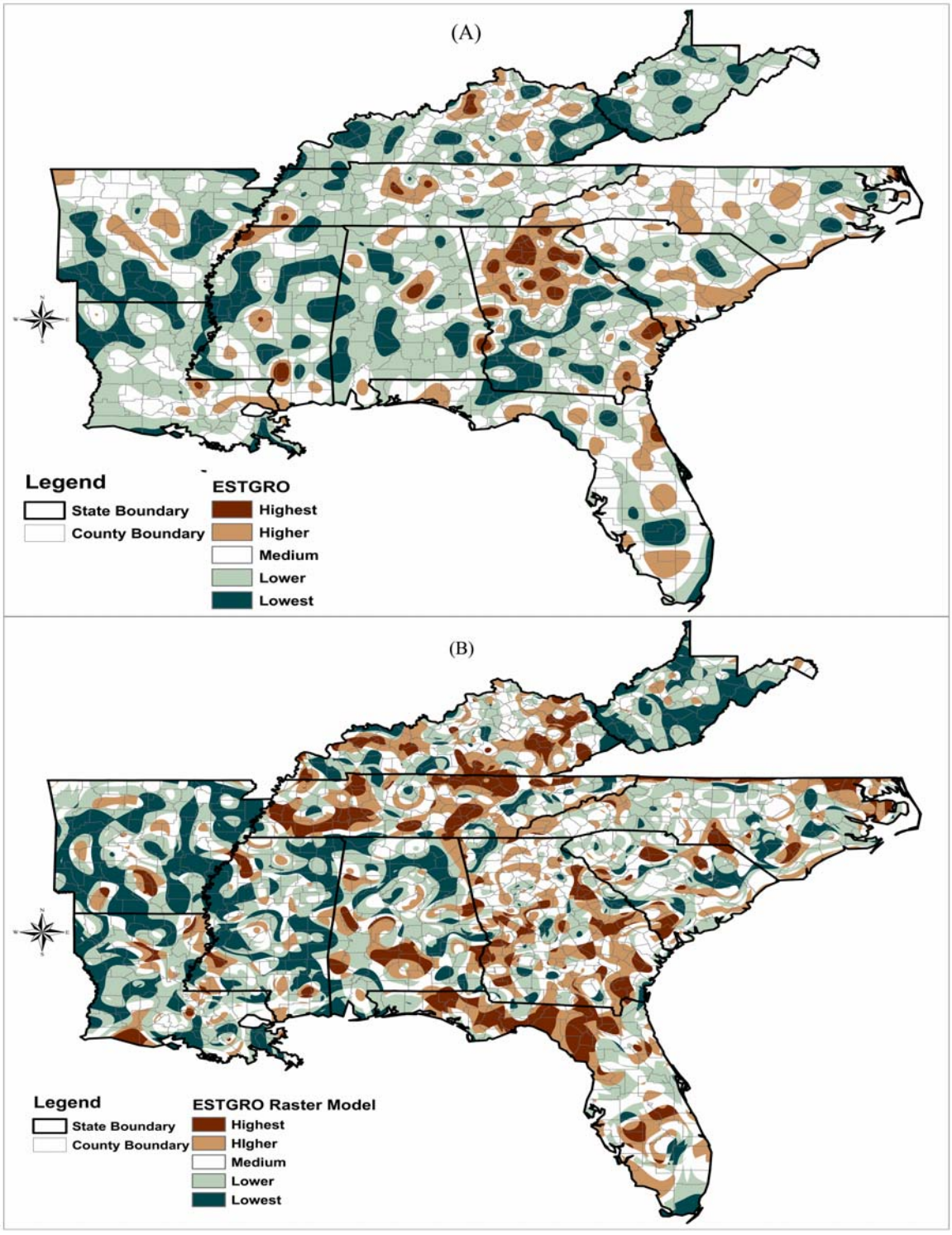

Figure 5.73 Actual *ESTGRO* vs. Predicted *ESTGRO* from GIS Raster Model

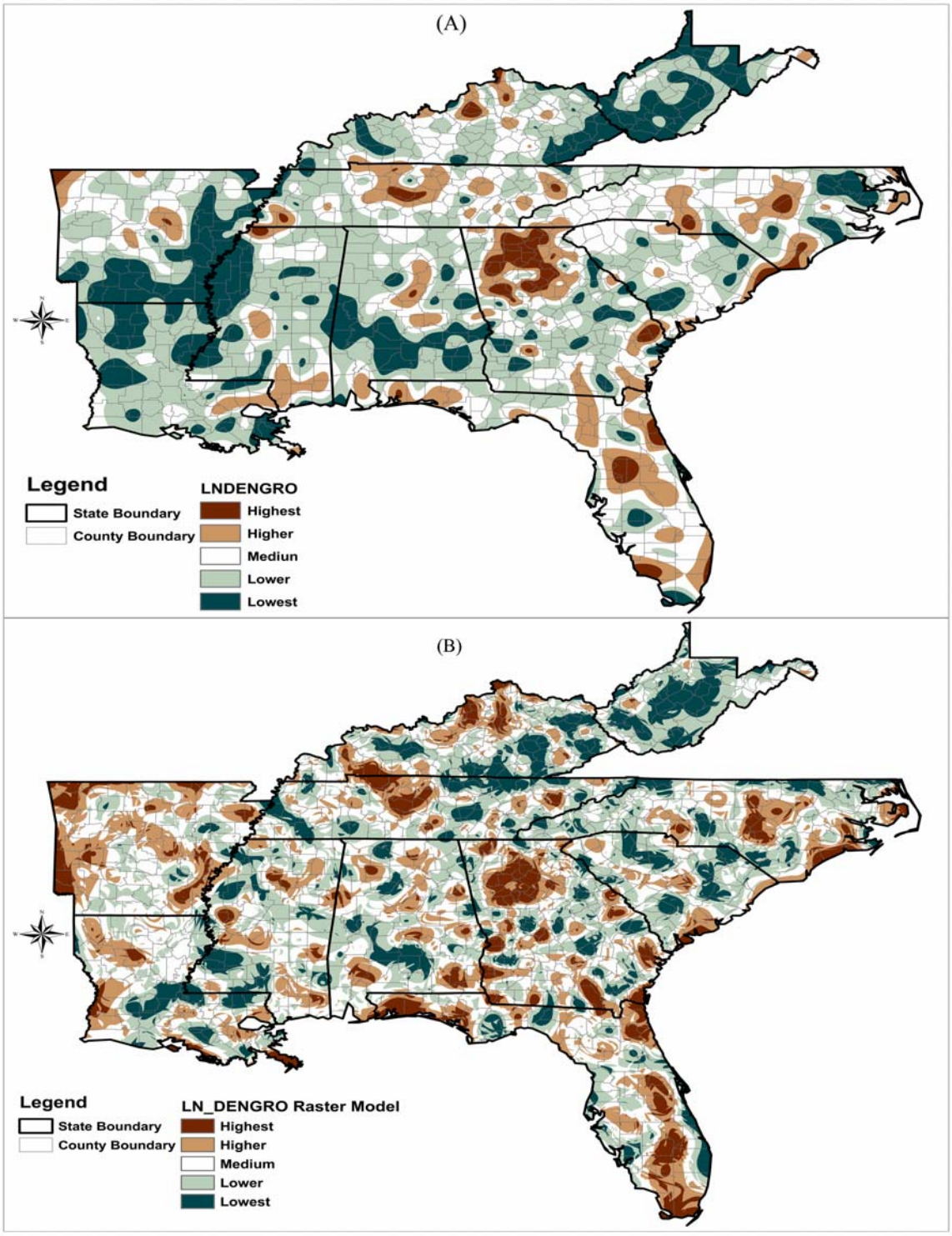

Figure 5.74 Actual *LNDENGRO* vs. Predicted *LNDENGRO* from GIS Raster Model

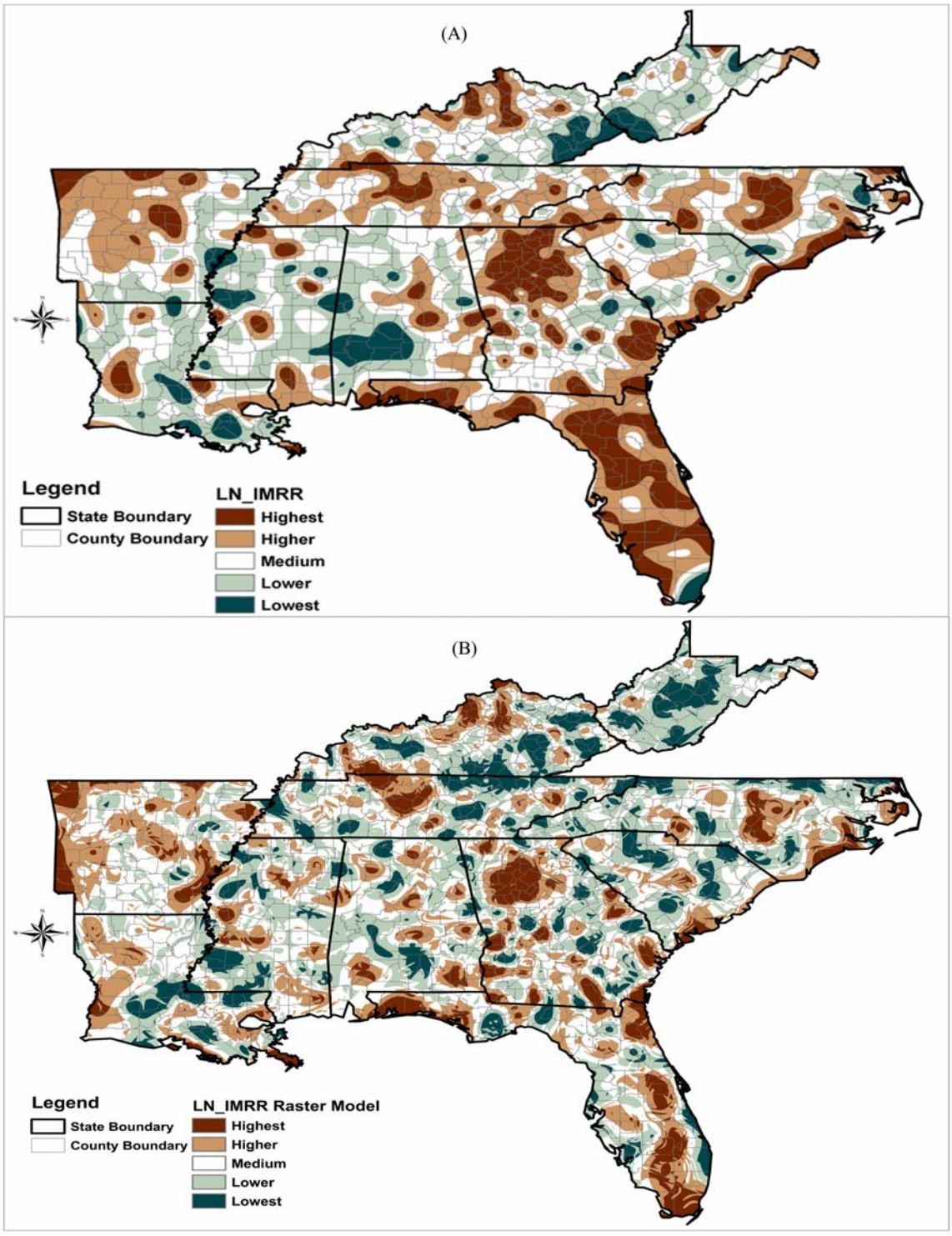

Figure 5.75 Actual *LNIMRR* vs. Predicted *LNIMRR* from GIS Raster Model

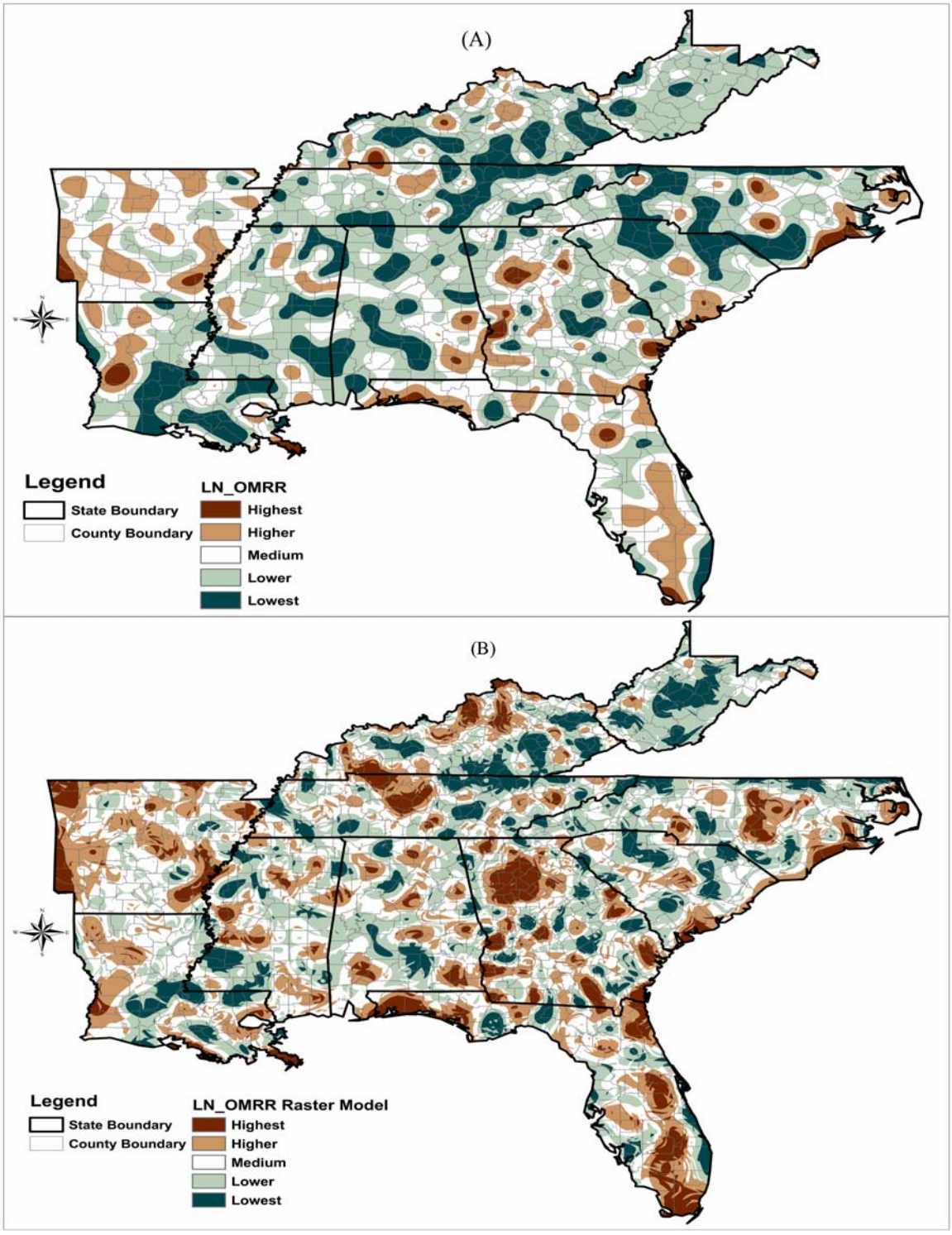

Figure 5.76 Actual *LNOMRR* vs. Predicted *LNOMRR* from GIS Raster Model

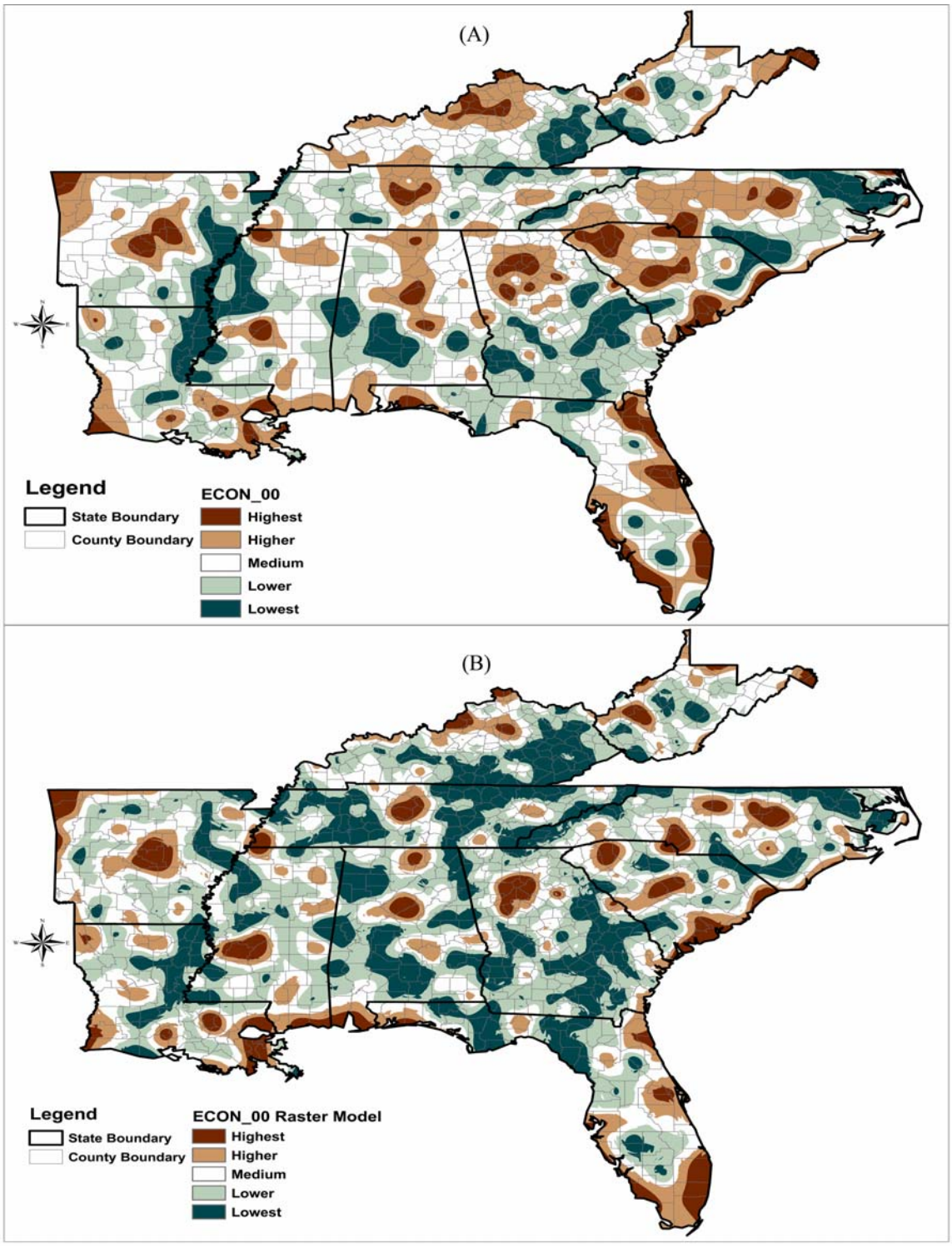

Figure 5.77 Actual *ECON_00* vs. Predicted *ECON_00* from GIS Raster Model

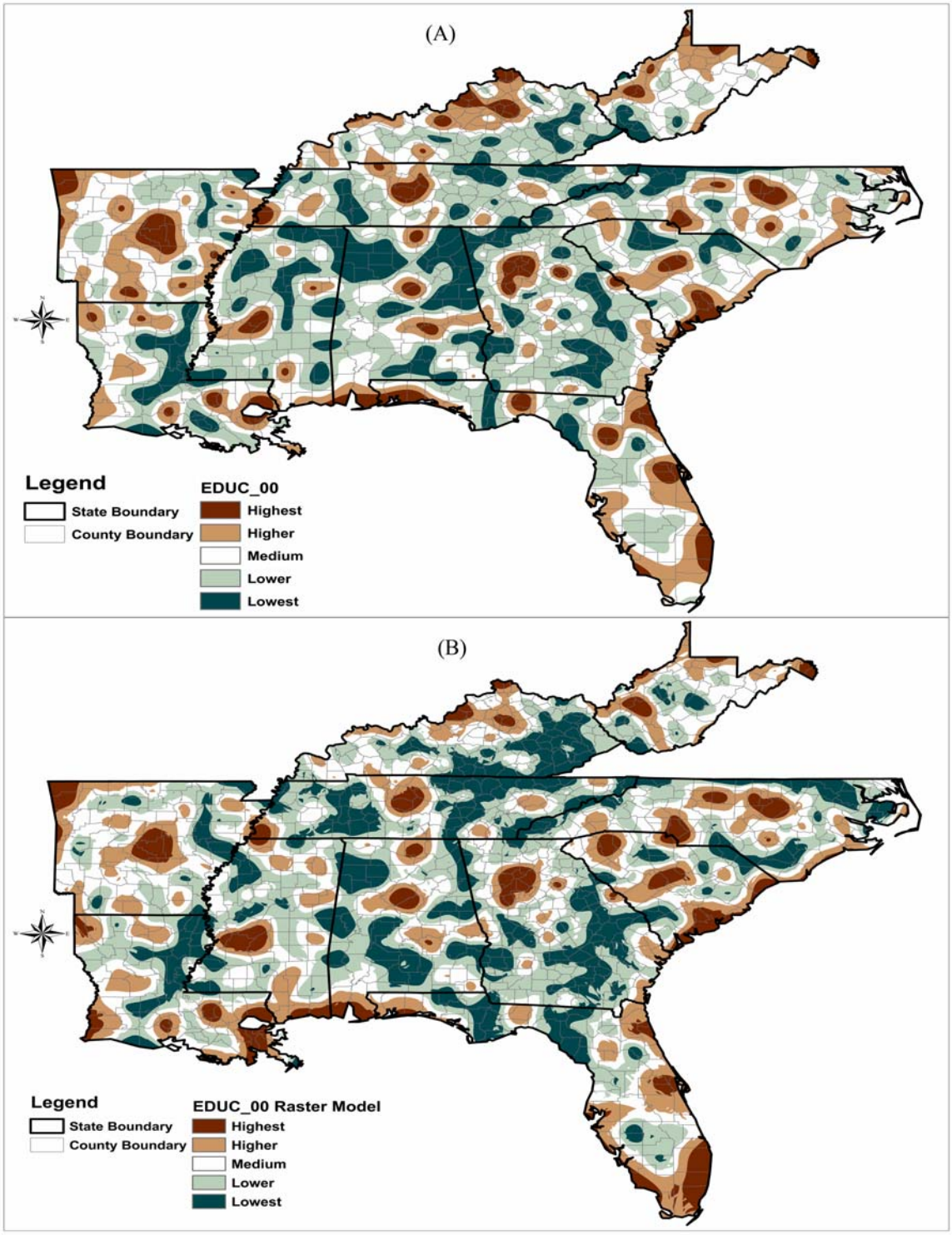

Figure 5.78 Actual *EDUC_00* vs. Predicted *EDUC_00* from GIS Raster Model

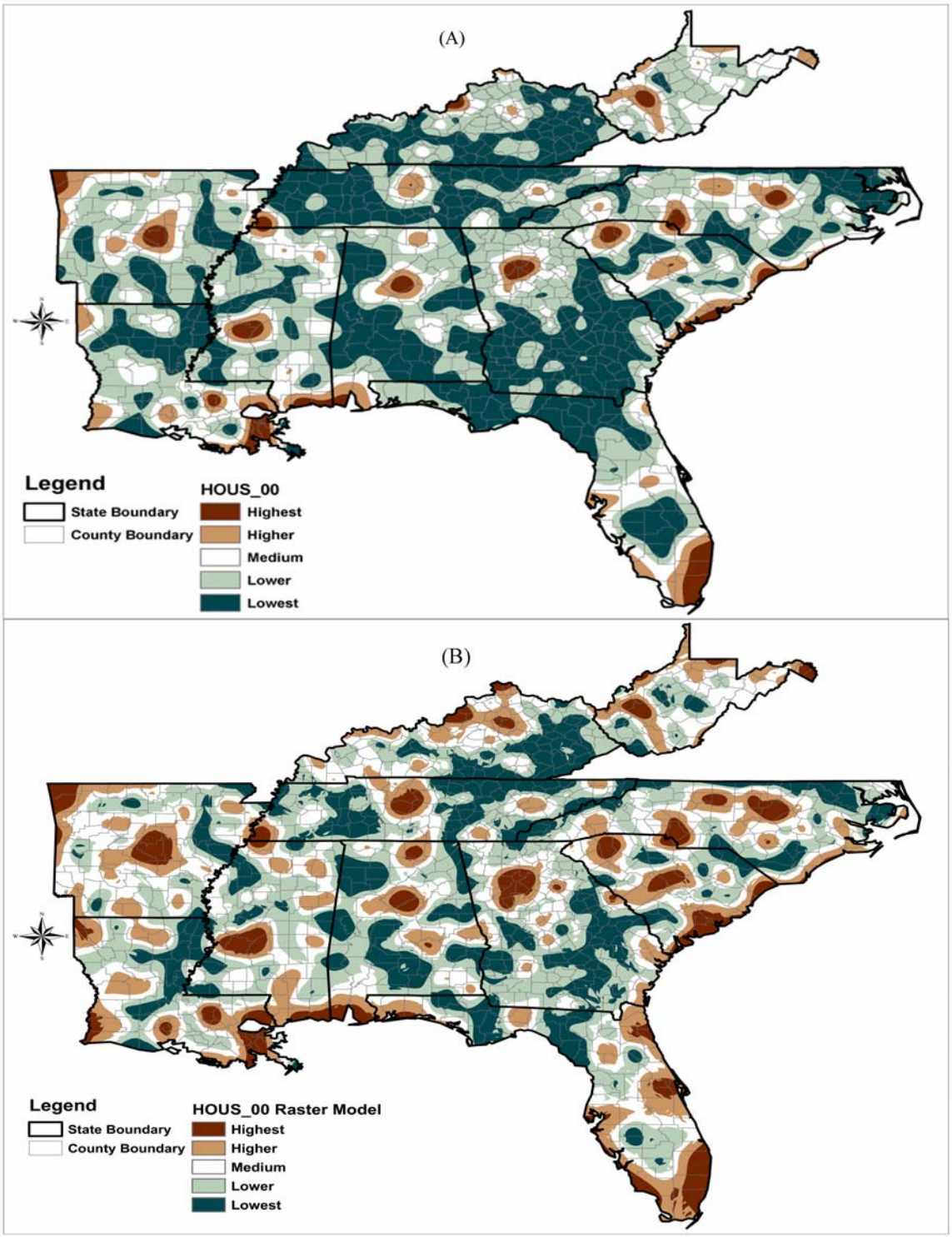

Figure 5.79 Actual *HOUS_00* vs. Predicted *HOUS_00* from GIS Raster Model

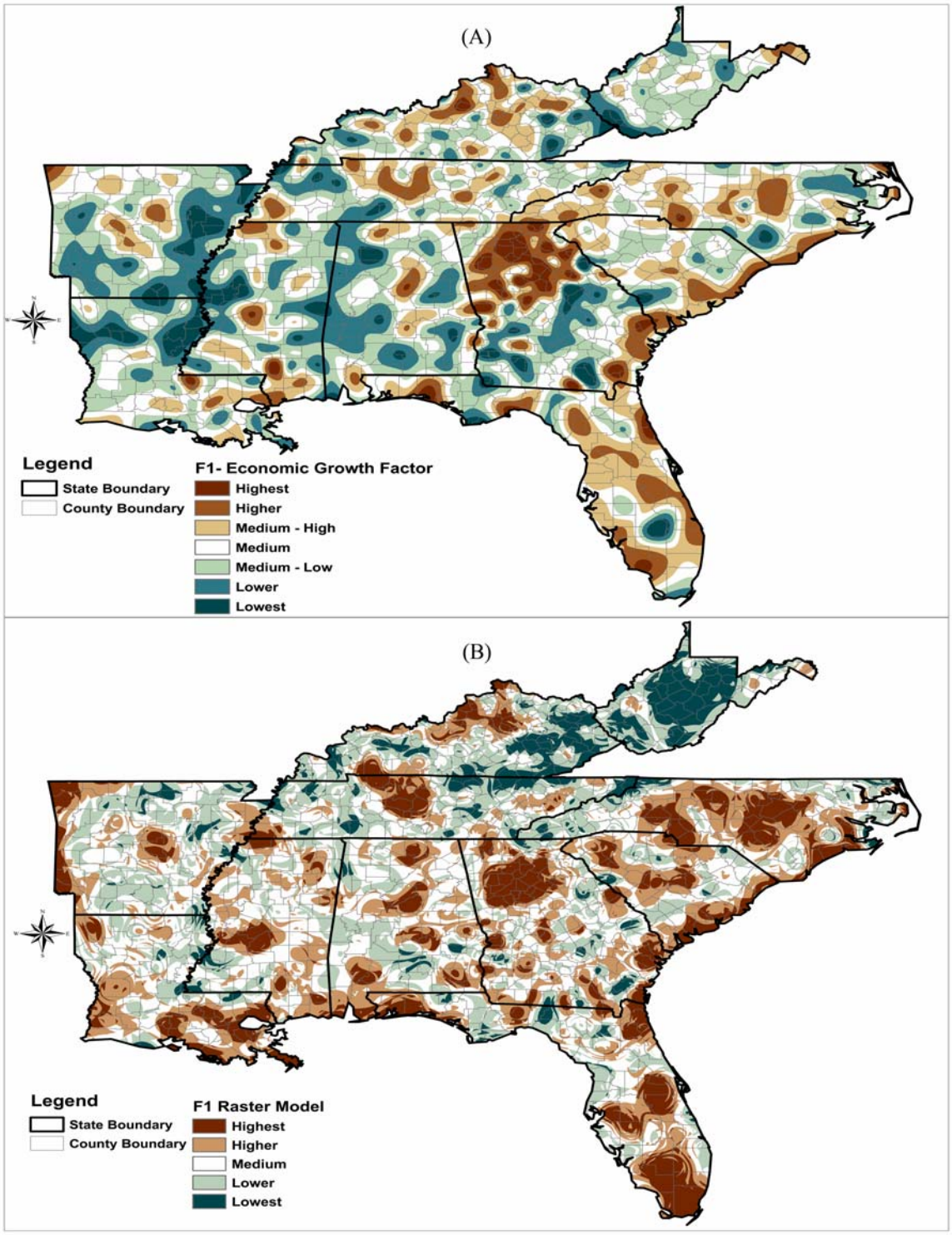

Figure 5.80 Predicted *F1* from Economic Growth Factor Model vs. Predicted *F1* from Raster Model

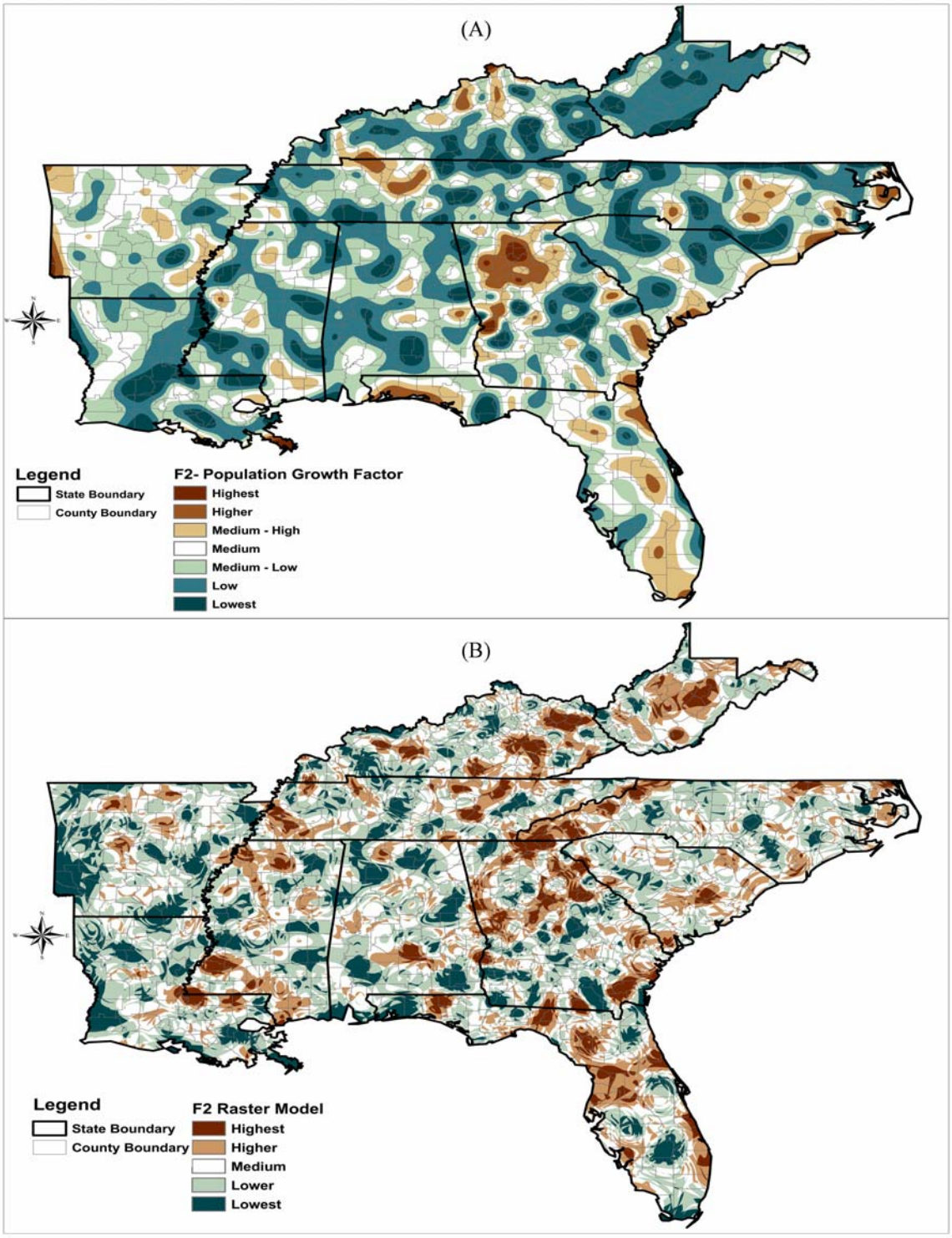

Figure 5.81 Predicted *F2* from Population Growth Factor Model vs. Predicted *F2* from Raster Model

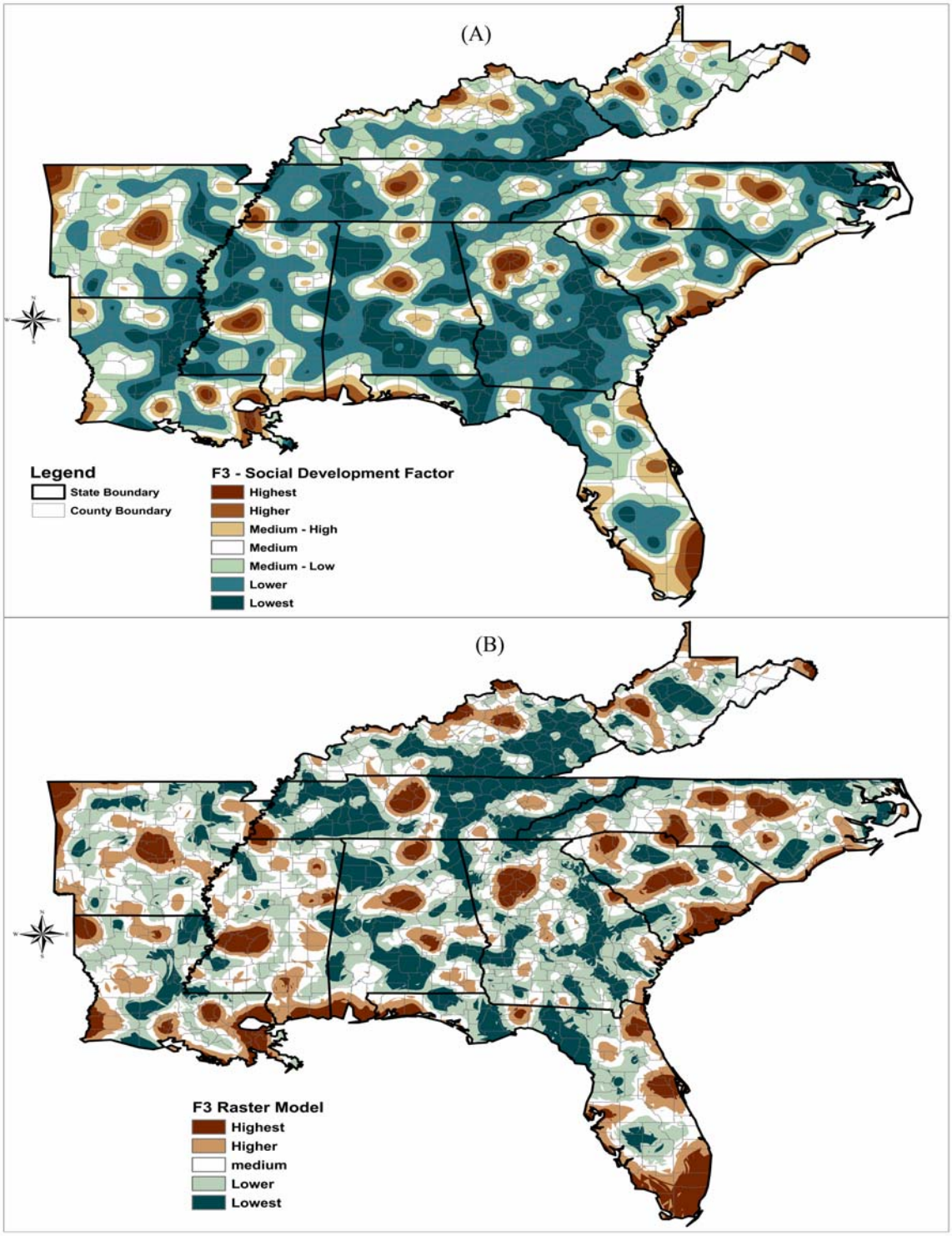

Figure 5.82 Predicted *F3* from Social Development Factor Model vs. Predicted *F3* from Raster Model

5.4 Spatial Lag Models

Spatial lag models are estimated by maximum likelihood estimation in GeoDa 0.9[e]. The spatial lag model includes a spatial lag of the response (dependent) variable. A spatial lag variable measures the neighborhood effect of the dependent variable. In other words, it measures how economic growth, population growth, and social development of neighboring counties affect economic growth, population growth and social development of a county. Other explanatory variables are included in the spatial lag model.

5.4.1 Results of the Spatial Lag Model for the Economic Growth

The spatial lag variables that represent the neighborhood effect of the economic growth variables and economic growth factor are *W_PINCGRO*, *W_EMPGRO*, *W_ESTGRO*, and *W_F1*. There is a spatial dependence whenever a value observed in one location is dependant on the values observed at neighboring locations. The main reason for spatial dependence is that the spatial aspect of the phenomenon dimension of a social or economic characteristic may be significant, as explained in Chapter III. GeoDa provides an assortment of diagnostics to detect spatial dependence. The results for each model for economic growth are summarized in Table 5.21.

The high value of log-likelihood and low value of Akaike Information Criterion (AIC) suggest that the overall fit of the economic growth factor and economic growth variables with their spatial lag variables are generally of the expected signs. The spatial lag terms for the average annual rate of change in per capita personal income (*PINCGRO)* and for the economic growth factor (*F1)* are highly significant. The spatial lag term for the average annual rate of change in the number of establishments is

significant at a 5% level. However, the spatial lag term for the average annual rate of change in the number of people employed is not significant.

Diagnostics for maximum likelihood estimation include the Breusch-Pagan test for heteroskedasticity and the Likelihood Ratio test for spatial dependence (Anselin, Luc, 2003). Diagnostics for maximum likelihood estimations did not include a test for multicollinearity (since the multicollinearity condition number is not greater than 20, thus, GeoDa did not test for multicollinearity of the model) (Anselin, Luc, 2003). The Breusch-Pagan test for heteroskedasticity is a test of the variance of the error term, as the BLUE requires constant error variance. The low probability of the Breusch-Pagan test suggests the existence of heteroskedasticity. However, GeoDa currently does not include functionality to deal with spatial heteroskedasticity (Anselin, Luc, 2003, Anselin, Luc, Ibnu Syabri and Youngihn Kho, 2006). This is no surprise because the variance could be affected by the spatial dependence in the data.

Results of the Likelihood Ratio test for spatial lag dependence suggest spatial dependence occurs in models for *PINCGRO* and *F1*. This means the introduction of the spatial lag term into *PINCGRO* and *F1* models does not make the spatial effect disappear. This means the neighborhood effect of the average annual rate of change in per capita personal income (*PINCGRO)* and the economic growth (F1) has a strongly positive and significant effect on *PINCGRO* and *F1* of a county. The result of the Likelihood Ratio test suggests spatial dependence occurs in models for *ESTGRO* at a 5% level. However, results of the Likelihood Ratio suggest that spatial dependence does not occur in models for *EMPGRO.*

Table 5.21 Spatial Lag Regression Model Results for Economic Growth Factor and Its Constructs, 1995 - 2000

Exogenous Variables	Endogenous Variables							
	PINCGRO		*EMPGRO*		*ESTGRO*		*F1*	
	Coef.	P_value	Coef.	P_value	Coef.	P_value	Coef.	P_value
W_PINCGRO	0.3752	0.0000						
W_EMPGRO			0.0514	0.1317				
W_ESTGRO					0.0631	0.0493		
W_F1							0.4344	0.0000
CONSTANT	0.6425	0.0000	0.9734	0.0000	0.9454	0.0000	-1.9428	0.0000
F1	0.0077	0.0000	0.0236	0.0000	0.0211	0.0000		
F2	-0.0017	0.0000	0.0000	0.9992	0.0011	0.0141	0.1647	0.0000
LNNATINC	-0.0072	0.0004	0.0004	0.7494	0.0058	0.0336	0.8394	0.0000
MEDAGE	-0.0003	0.0608	0.0000	0.9898	0.0002	0.5225	0.0515	0.0000
LNRACE	-0.0004	0.1051	0.0004	0.2596	0.0003	0.2721	-0.0659	0.0000
ECON_90	-0.0021	0.3771	-0.0031	0.3672	0.0043	0.1634	0.6064	0.0000
EDUC_90	0.0075	0.0318	-0.0018	0.7285	-0.0048	0.2958	-0.1933	0.4142
HOUS_90	0.0043	0.1990	-0.0008	0.8684	-0.0009	0.8477	-0.2014	0.3486
LNGRAV	0.0005	0.0346	-0.0006	0.0968	-0.0003	0.3148	-0.0325	0.0407
Goodness of Fit Test								
R-Squared	0.4232		0.6723		0.7187		0.4413	
Log-Likelihood	3065.8		2716.37		2819.33		863.529	
AIC	- 6109.6		- 5410.74		- 5616.65		-1747.06	
Breusch-Pagan Test*	-		-	-	-	-	-	-
Degrees of Freedom	9		9		9		8	
Value	57.7101		373.8377		503.7821		60.5778	
P_Value	0.0000		0.0000		0.0000		0.0000	
Likelihood Ratio Test**								
Degrees of Freedom	1		1		1		1	
Value	93.0000		2.1975		3.7831		123.0382	
P_Value	0.0000		0.1382		0.0518		0.0000	

Note: * Diagnostics for Heteroscedasticity

** Diagnostics for Spatial Dependence

The coefficient estimates for *W_PINCGRO, F1, F2, LNNATINC*, and the intercept of the spatial lag model for the average annual rate of change in per capita personal

income (*PINCGRO*) are highly significant. The coefficient estimates for *EDUC_90* and *LNGRAV* are significant at a 5% level. The estimated coefficients for *MEDAGE* and *LNRACE* are significant at a 10% level. The estimated coefficient is significant neither for *ECON_90* nor *HOUS_90*. *W_PINCGRO, F1, EDUC_90,* and *LNGRAV* have a significant positive effect toward *PINCGRO*. *LNNATINC, MEDAGE,* and *LNRACE* have a significant negative effect toward *PINCGRO*.

The coefficient estimates for *F1* and the intercept of the spatial lag model for the average annual rate of change in number of people employed (*EMPGRO*) are highly significant. The estimated coefficient for *LNGRAV* is significant at a 10% level. The rest of the estimates are not significant. *F1* has a significant positive effect on *EMPGRO*. *LNGRAV* has a significant negative effect on *EMPGRO*.

The coefficient estimates for *F1* and the intercept of the spatial lag model for the average annual rate of change in the number of establishments (*ESTGRO*) are highly significant. The coefficient estimates for *W_ESTGRO*, *F2,* and *LNNATINC* are significant at a 5% level. The rest of the coefficient estimates are not significant. *W_ESTGRO*, *F1*, *F2*, and *LNNATINC* have a significant positive effect on *ESTGRO*.

The coefficient estimates for *W_F1, F2, LNNATINC*, *MEDAGE*, *LNRACE, ECON_90,* and the intercept of the spatial lag model for the economic growth factor (*F1*) are highly significant. The coefficient estimate for *LNGRAV* is significant at a 5% level. The coefficient estimates for EDUC*_90* and *HOUS_90* are not significant. *W_F1, F2, LNNATINC*, *MEDAGE*, and *ECON_90* have significant positive effects on *F1*. *LNRACE* and *LNGRAV* have significant negative effects on *F1*.

The predicted coefficient estimates of the spatial lag model for *PINCGRO*, *EMPGRO*, and *ESTGRO* versus their actual values are visualized in Figure 5.83 to Figure 5.85. The predicted coefficient estimates of the spatial lag model for *F1* versus the predicted coefficient estimates of the economic growth factor measurement model are visualized in Figure 5.86.

In terms of map similarities, the actual vs. predicted dependent variables from the spatial lag models for economic growth match very closely. Although the predicted values are underestimated slightly in the overall models, the counties with the highest (or higher, medium, lower, lowest) predicted values are generally also in the highest (or higher, medium, lower, lowest) categories in actual values of the variables. Therefore, the validities of the spatial lag models for economic growth are strong. The counties in the MSA appear to have a higher economic growth rate, along with neighboring counties associated with the MSA and large cities. Urban 6 & 7 and rural areas have lower economic growth rates. Coastal counties have higher economic growth rates than non-coastal counties. The strengths of influencing exogenous variables are reported in Table 5.21.

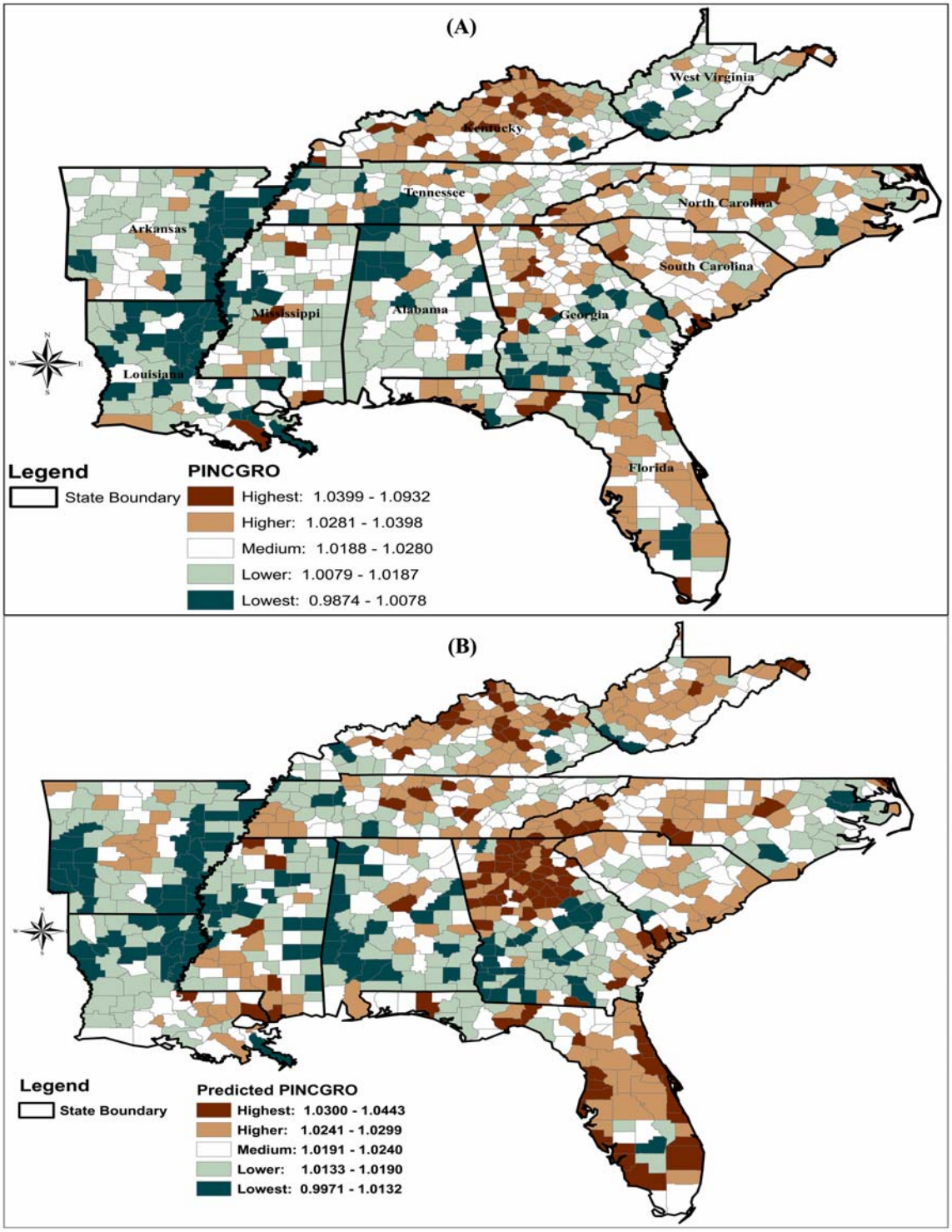

Figure 5.83 Actual *PINCGRO* vs. Predicted *PINCGRO* from the Spatial Lag Model

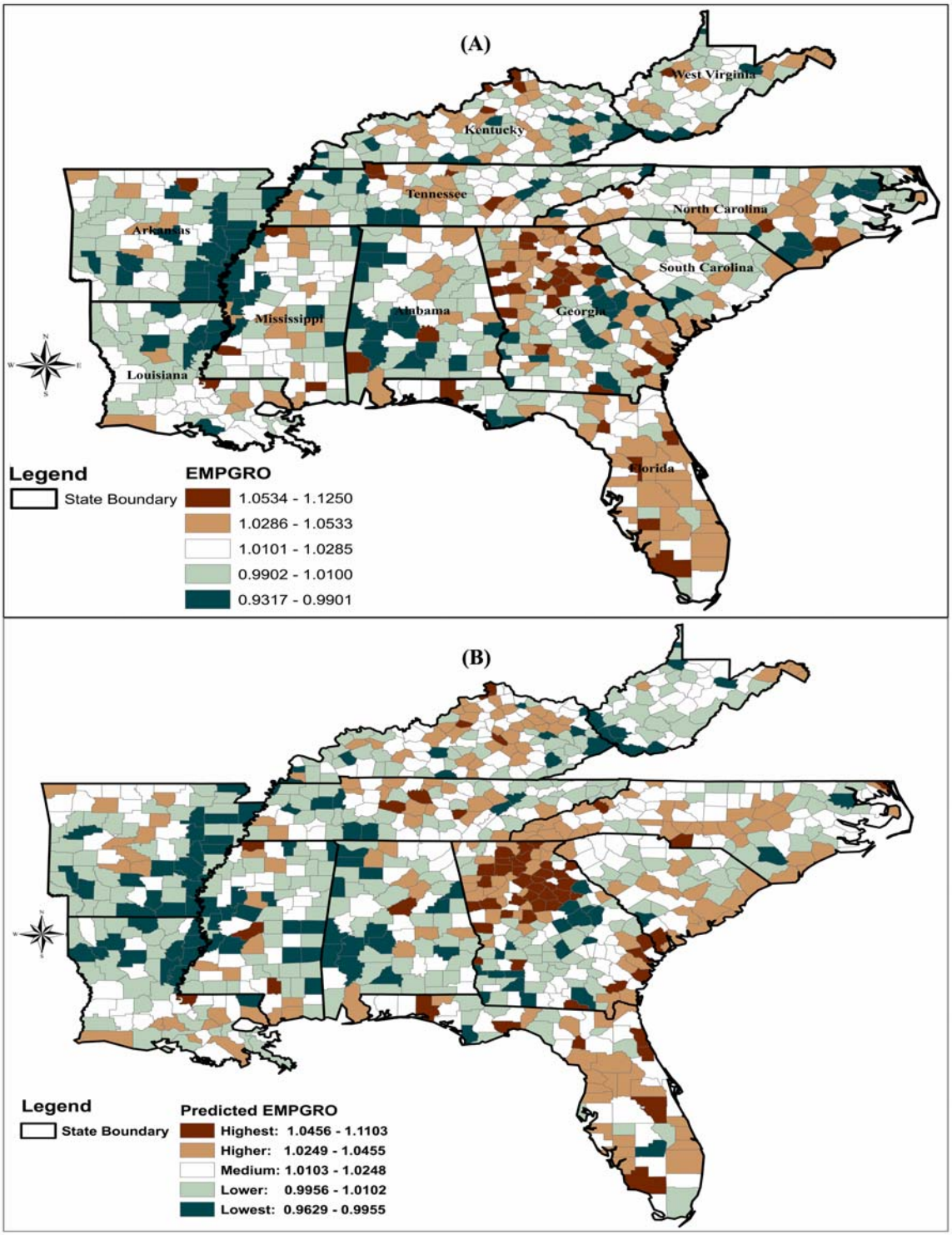

Figure 5.84 Actual *EMPGRO* vs. Predicted *EMPGRO* from the Spatial Lag Model

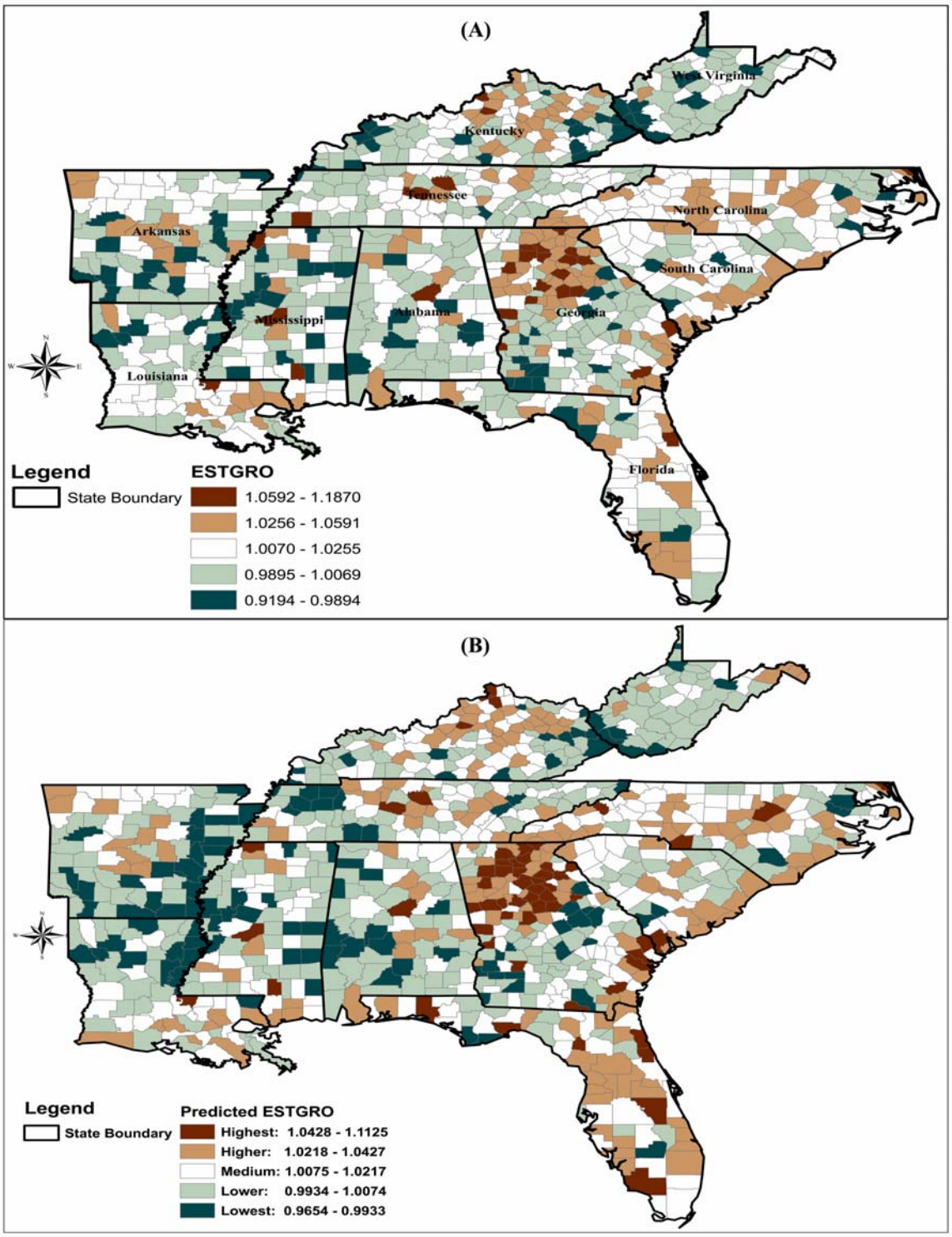

Figure 5.85 Actual *ESTGRO* vs. Predicted *ESTGRO* from the Spatial Lag Model

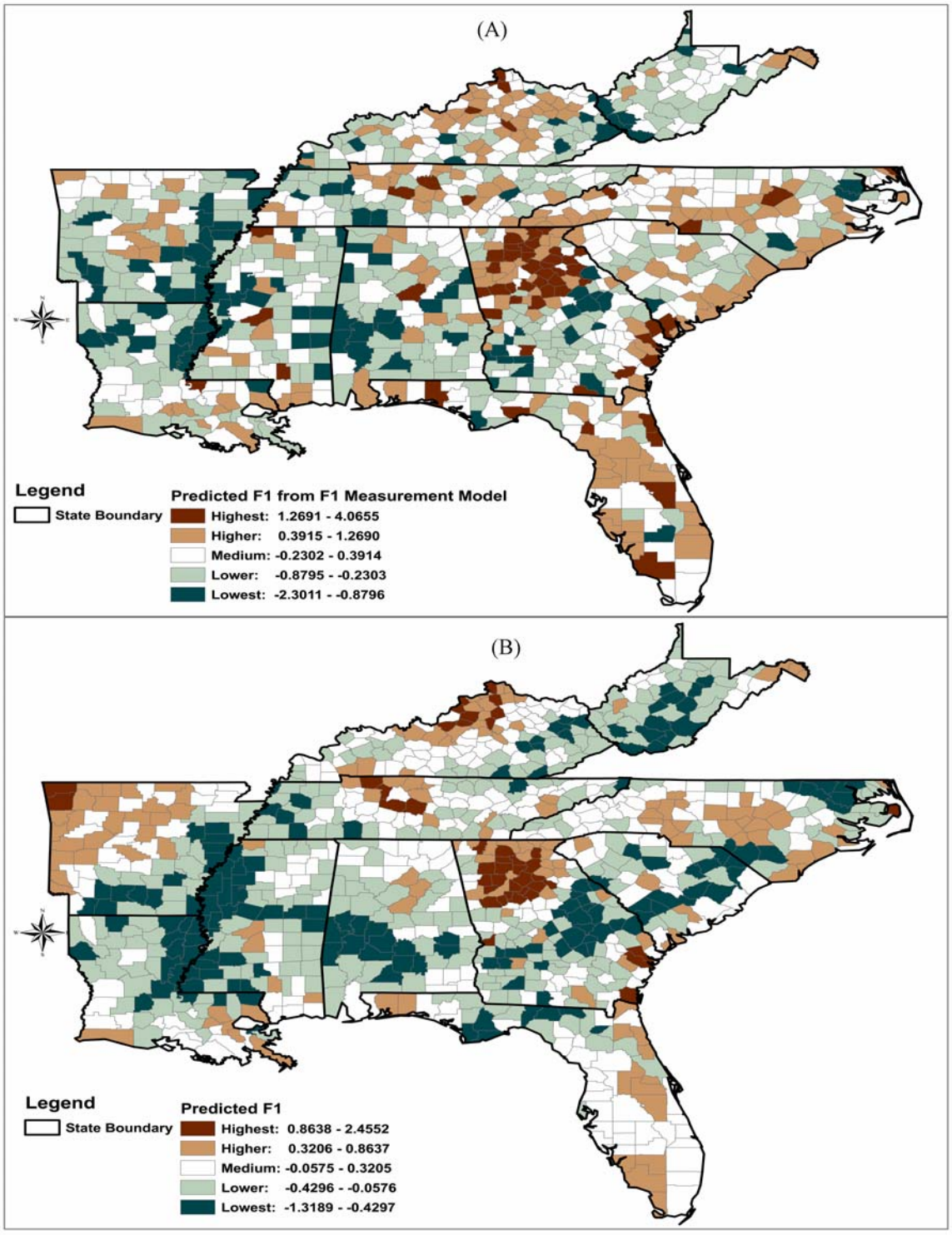

Figure 5.86 Predicted *F1* from the Economic Growth Measurement Model vs. Predicted *F1* from the Spatial Lag Model

5.4.2 Results of the Spatial Lag Model for the Population Growth

The spatial lag of population growth variables and factors represent the neighborhood effects of those variables. They include *W_LNDENGRO*, *W_LNIMRR*, *W_LNOMRR*, and *W_F2*. The maximum likelihood estimation results for the spatial lag models for the population growth factors and its constructs are summarized in Table 5.22.

The high value of log-likelihood and low value of AIC suggest that the overall fit of the population growth factor and its constructs models with their spatial lag variables fit the data well. The spatial lag terms for all population growth variables (*LNDENGRO, LNIMRR,* and *LNOMRR)* and population growth factor (*F2*) are highly significant. This means the neighborhood effect of the population growth has a strongly positive and significant effect on the population growth of a county.

The low probability of the Breusch-Pagan test suggests the existence of heteroskedasticity. The existence of heteroskedasticity can be explained by the variance, which is possibly affected by the spatial dependence in the data.

Results of the Likelihood Ratio test for the spatial lag dependence suggest spatial dependence occurs in all of the models for population growth. This means the introduction of the spatial lag term into each corresponding model does not make the spatial effect go away. However, for all models, the spatial lag term improved the model fit with the data; the R-squared of the models were greater than 0.49.

Table 5.22 Spatial Lag Regression Model Results for Population Growth Factor and Its Constructs, 1995 - 2000

Exogenous Variables	Endogenous Variables							
	LNDENGRO		*LNIMRR*		*LNOMRR*		*F2*	
	Coef.	P_Value	Coef.	P_Value	Coef.	P_Value	Coef.	P_Value
W_LNDENGRO	0.2234	0.0000						
W_LNIMRR			0.4350	0.0000				
W_LNOMRR					0.1714	0.0001		
W_F2							0.3860	0.0000
CONSTANT	-0.0222	0.0210	2.0130	0.0000	3.3387	0.0000	-3.3900	0.0000
F1	0.0070	0.0000	0.1647	0.0000	-0.0599	0.0000	0.2625	0.0000
F2	0.0032	0.0000	0.0636	0.0000	0.1843	0.0000		
LNNATINC	0.0128	0.0000	0.0109	0.8462	-0.2271	0.0000	1.7353	0.0000
MEDAGE	0.0009	0.0000	-0.0014	0.7785	-0.0157	0.0000	0.0862	0.0000
LNRACE	-0.0004	0.0194	0.0059	0.3143	0.0090	0.0075	0.0159	0.4084
ECON_90	0.0061	0.0991	0.3861	0.0000	0.0523	0.1383	-0.0519	0.8032
EDUC_90	-0.0129	0.0038	0.1364	0.1520	0.2965	0.0000	2.1350	0.0000
HOUS_90	-0.0096	0.0336	-0.2673	0.0039	0.0409	0.4243	-0.1373	0.6498
LNGRAV	-0.0002	0.2096	-0.0132	0.0392	-0.0012	0.7385	-0.0649	0.0019
Goodness of Fit Test								
R-Squared	0.7054		0.5780		0.7012		0.4855	
Log Likelihood	3291.21		-18.8782		549.671		-1114.95	
AIC	-6560.43		59.7565		-1077.34		2249.9	
Breusch - Pagan Test*								
DF	9		9		9		8	
Value	499.4395		123.1711		1292.5490		110.1604	
P_Value	0.0000		0.0000		0.0000		0.0000	
Likelihood Ratio Test**								
DF	1		1		1		1	
Value	48.5598		142.0098		29.5355		98.9240	
P_Value	0.0000		0.0000		0.0001		0.0000	

Note: * Diagnostics for Heteroscedasticity

** Diagnostics for Spatial Dependence

The coefficient estimates for *W_LNDENGRO, F1, F2, LNNATINC*, *MEDAGE* and *EDUC_90* of the spatial lag model for the average annual rate of change in the

population density (*LNDENGRO*) are highly significant. The coefficient estimates for *LNRACE*, *HOUS_90*, and the intercept are significant at a 5% level. The coefficient estimate for *ECON_90* is significant at a 10% level. The coefficient estimate for *LNGRAV* is not significant. *W_LNDENGRO, F1, F2, LNNATINC, MEDAGE,* and *ECON_90* have significant positive effects on *LNDENGRO*. *LNRACE*, *EDUC_90*, and *HOUS_90* have significant negative effects on *LNDENGRO*.

The coefficient estimates for *W_LNIMRR, F1, F2, ECON_90* and the intercept of the spatial lag model for the in-migration rate (*LNIMRR*) are highly significant. The coefficient estimate for *LNGRAV* is significant at a 5% level. The rest of the coefficient estimates are not significant. *W_LNIMRR, F1, F2,* and *ECON_90* have significant positive effects on *LNIMRR*. *HOUS_90* and *LN_GRAV* have significant negative effects on *LNIMRR*.

The coefficient estimates for *W_LNOMRR, F1, F2, LNNATINC*, *MEDAGE, LNRACE, EDUC_90*, and the intercept of the spatial lag model for the out-migration rate (*LNOMRR*) are highly significant. The other three coefficient estimates are not significant. *W_LNOMRR, F2, LNRACE,* and *EDUC_90* have significant positive effects on *LNOMRR*. *F1*, *LNNATINC*, and *MEDAGE* have a significant negative effect on *LNOMRR*.

The coefficient estimates for *W_F2, F1, LNNATINC*, *MEDAGE, EDUC_90, LNGRAV,* and the intercept of the spatial lag model for the population growth factor (*F2*) are highly significant. The other three coefficient estimates are not significant. *W_F2, F1, LNNATINC*, *MEDAGE,* and *EDUC_90* have significant positive effects on *F2*. *LNGRAV* has a significant negative effect on *F2*.

The predicted coefficient estimates of the spatial lag model for *LNDENGRO*, *LNIMRR*, and *LNOMRR* versus their actual values are visualized in Figure 5.87 to Figure 5.89. The predicted coefficient estimates of the spatial lag model for *F2* versus the predicted coefficient estimates of the population growth factor measurement model are visualized in Figure 5.90.

In terms of map similarities, the actual versus predicted dependent variables from the spatial lag models for population growth match very well or expectantly. Although the predicted values are underestimated slightly in the overall models, the counties with the highest (or higher, medium, lower, lowest) predicted values are also generally in the highest (or higher, medium, lower, lowest) category in actual values of the variables. Therefore the validities of the spatial lag models for population growth are strong. The counties in the MSAs appear to have higher population growth rates, along with the neighboring counties associated with those MSAs, based on Figure 5.90. However, the out-migration rates for counties in the MSAs are higher than for other counties, as illustrated in Figure 5.89. Urban 6 & 7 and rural areas have lower population growth rates. Coastal counties have high population growth rates. The strengths of influencing exogenous variables are reported in Table 5.22.

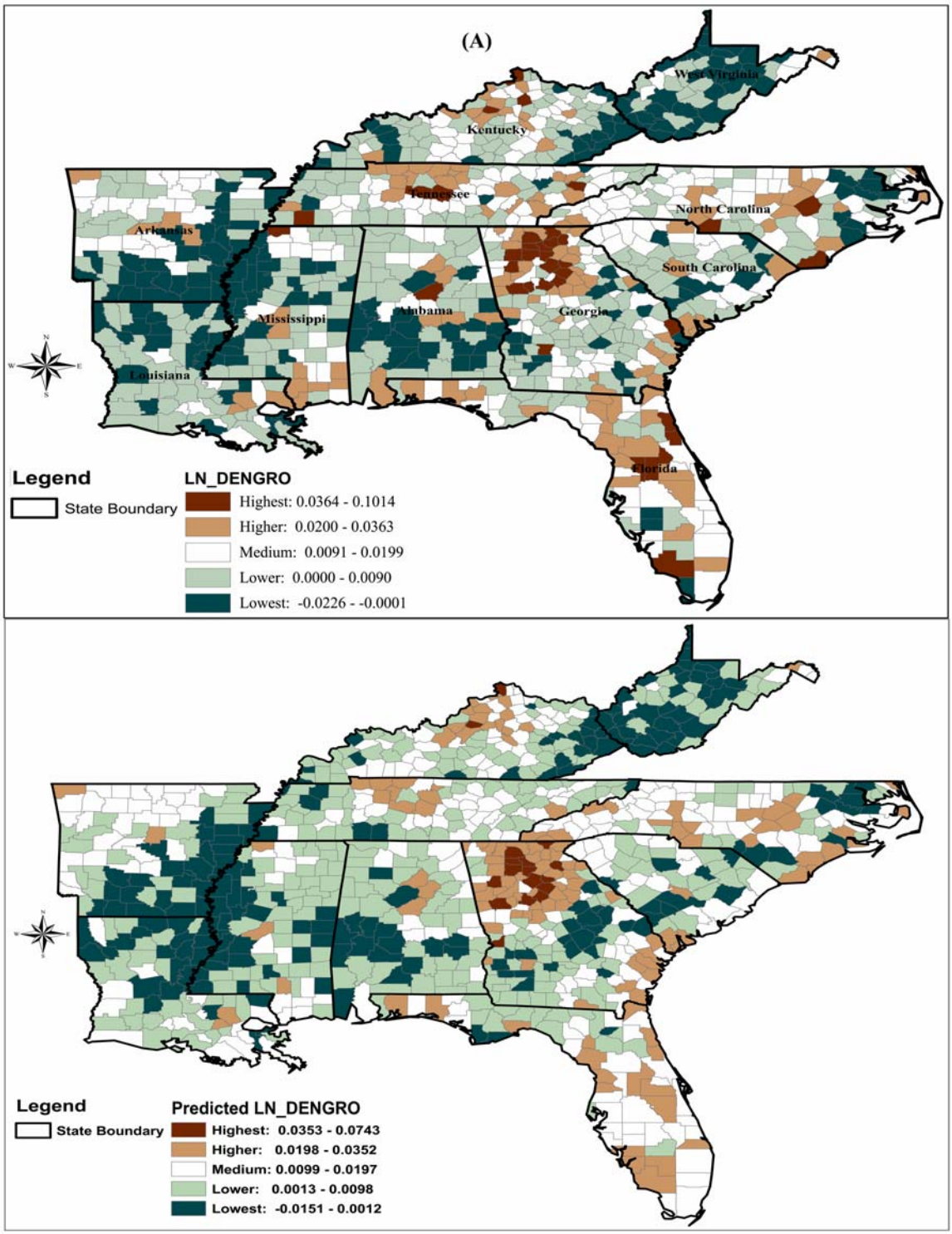

Figure 5.87 Actual *LNDENGRO* vs. Predicted *LNDENGRO* from the Spatial Lag Model

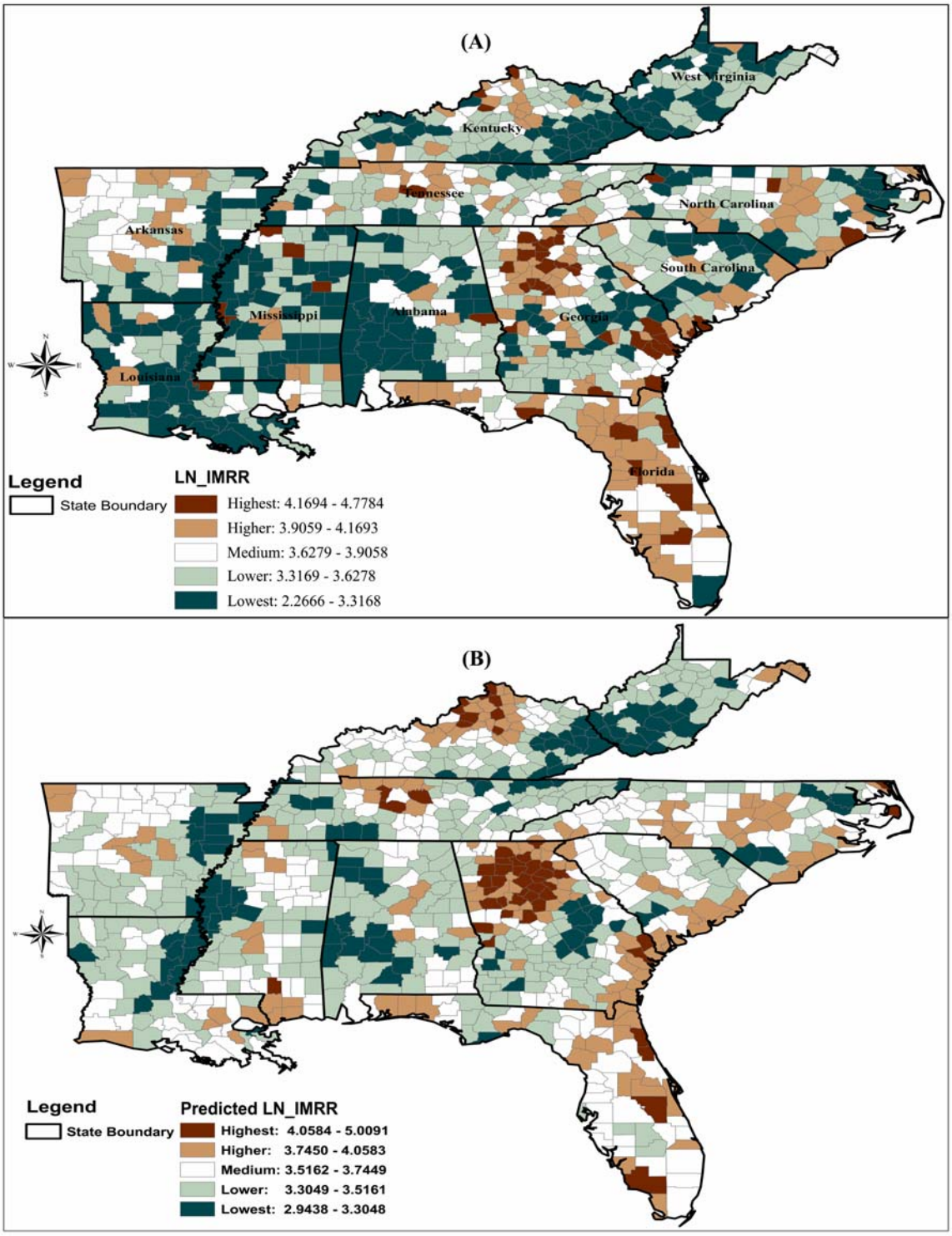

Figure 5.88 Actual *LNIMRR* vs. Predicted *LNIMRR* from the Spatial Lag Model

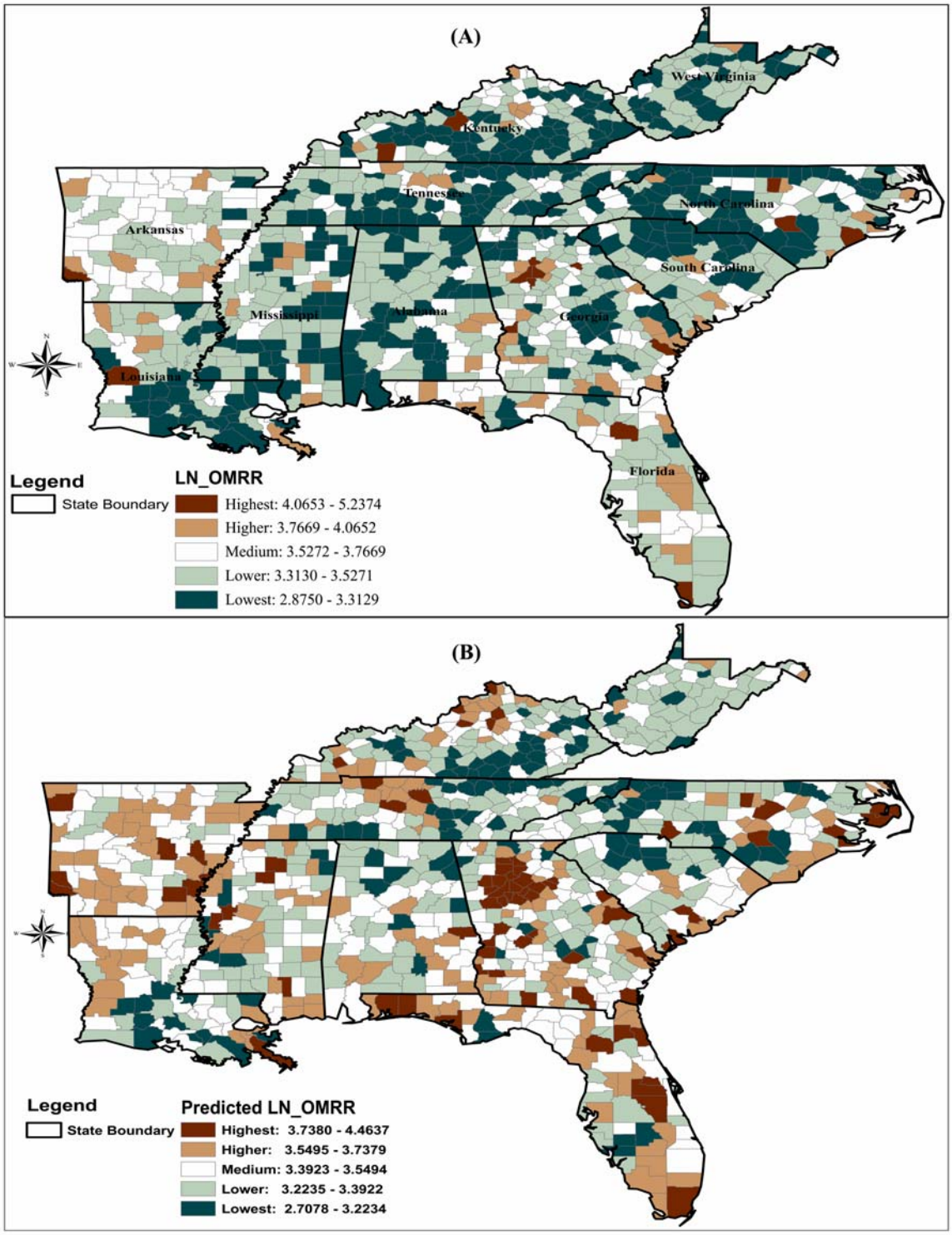

Figure 5.89 Actual *LNOMRR* vs. Predicted *LNOMRR* from the Spatial Lag Model

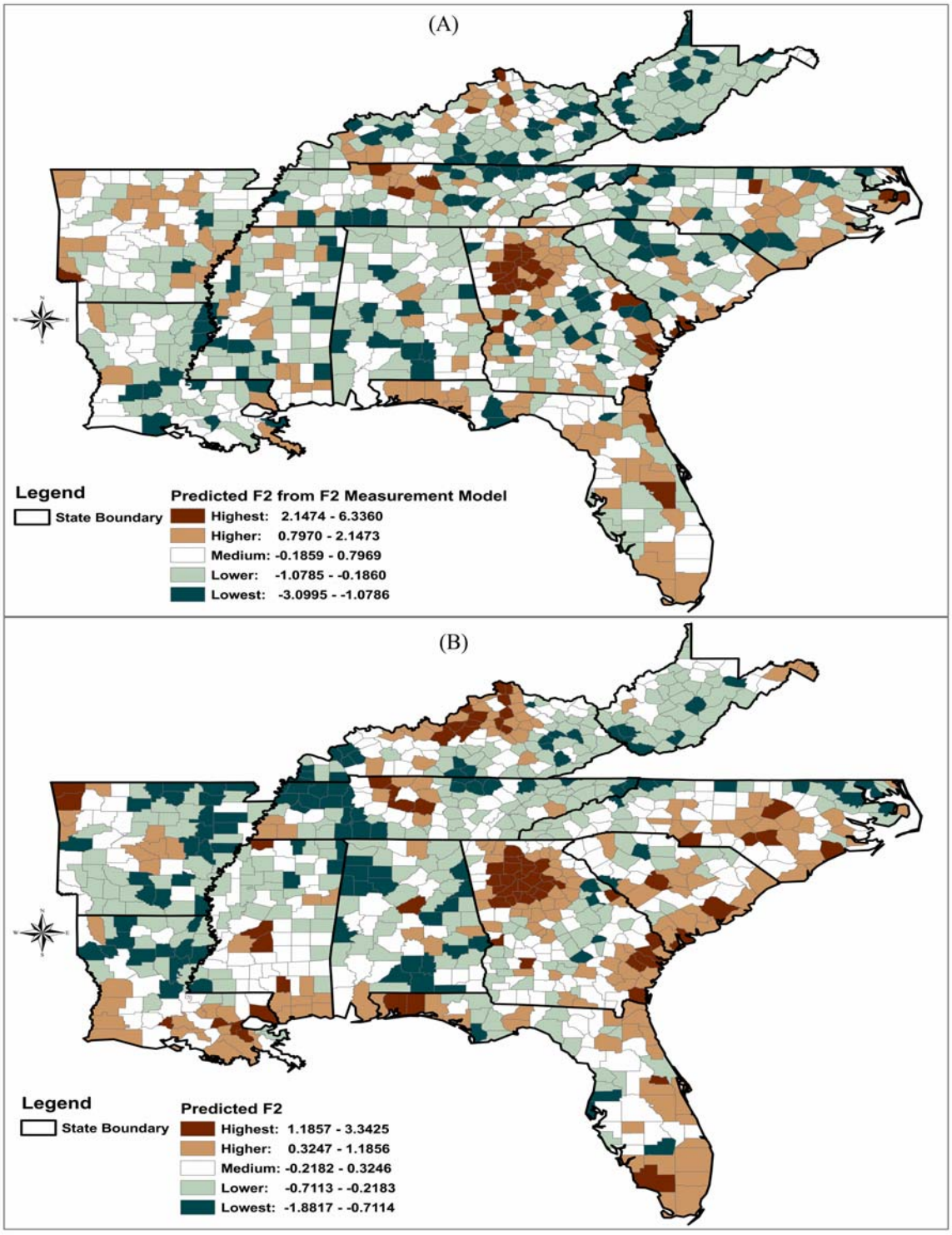

Figure 5.90 Predicted *F2* from the Population Growth Measurement Model vs. Predicted *F2* from the Spatial Lag Model

5.4.3 Results of the Spatial Lag Model for the 2000 Social Development

The spatial lag models for the 2000 social development include a spatial lag response (dependent) variable. The variables representing the neighborhood effect of the 2000 social development variables and social development factor are *W_ECON_00*, *W_EDUC_00*, *W_HOUS_00*, and *W_F3*. The maximum likelihood estimation results for the spatial lag models for the 2000 social development factor and its constructs are summarized in Table 5.23.

The high value of the log-likelihood and low value of AIC suggest that the overall fit of the models for the economic growth factor and its constructs with their spatial lag variables are a good fit for the data. The spatial lag terms for the 2000 social development variables (*ECON_00, EDUC_00,* and *HOUS_00)* and 2000 social development factor (*F3*) are highly significant. This means the neighborhood effect of the 2000 social development has a strongly positive and significant effect toward the 2000 social development of a county.

The low probability of the Breusch-Pegan test for heteroskedasticity for all models suggests the existence of heteroskedasticity. The existence of heteroskedasticity can be explained by the variance that may be affected by the spatial dependence in the data.

Results of the Likelihood Ratio test for the spatial lag dependence suggest spatial dependence occurs in all the models for the 2000 social development. This means although there is an introduction of the spatial lag term into each corresponding model, it did not make the spatial effect disappear. However, for all models, the spatial lag term improved the model fit with the data; the R-squared of the models are greater than 0.92.

Table 5.23 Spatial Lag Regression Model Results for Social Development Factor and Its Constructs, 2000

Exogenous Variables	Endogenous Variables							
	ECON_00		*EDUC_00*		*HOUS_00*		*F3*	
	Coef.	P_Value	Coef.	P_Value	Coef.	P_Value	Coef.	P_Value
W_ECON_00	0.1272	0.0000						
W_EDUC_00			0.0851	0.0002				
W_HOUS_00					0.0448	0.0034		
W_F3							0.1231	0.0000
CONSTANT	0.2467	0.0000	0.4284	0.0000	0.1949	0.0000	-2.3456	0.0000
F1	0.0211	0.0000	-0.0154	0.0000	0.0031	0.0083	0.1292	0.0000
F2	-0.0012	0.5692	0.0008	0.5651	-0.0008	0.3098	0.0259	0.0021
F3	0.1701	0.0000	0.2124	0.0000	0.0432	0.0000		
LNNATINC	0.0214	0.0827	-0.0118	0.1426	0.0027	0.5924	0.0047	0.9257
MEDAGE	0.0030	0.0056	-0.0002	0.7923	-0.0014	0.0016	0.0087	0.0481
LNRACE	-0.0072	0.0001	0.0049	0.0000	-0.0009	0.0986	-0.0378	0.0000
ECON_90	0.4407	0.0000	-0.1974	0.0000	-0.0548	0.0000	1.3190	0.0000
EDUC_90	-0.2694	0.0000	0.3102	0.0000	-0.1353	0.0000	2.1721	0.0000
HOUS_90	-0.5039	0.0000	-0.5537	0.0000	0.8693	0.0000	2.8507	0.0000
LNGRAV	0.0037	0.0852	0.0012	0.1927	-0.0039	0.0000	-0.0027	0.6323
Goodness of Fit Test								
R-Squared	0.9176		0.9360		0.9793		0.9438	
Log Likelihood	1412.79		1813.03		2553.24		100.328	
AIC	-2801.58		-3602.36		-4482.49		-178.655	
Breusch - Pagan Test*	-		-	-	-	-	-	-
DF	10		10		10		9	
Value	60.9709		50.2535		253.1068		43.7232	
P_Value	0.0000		0.0002		0.0000		0.0016	
Likelihood Ratio Test**								
DF	1		1		1		1	
Value	43.6938		27.1770		21.4269		58.4680	
P_Value	0.0000		0.0002		0.0037		0.0000	

Note: * Diagnostics for Heteroscedasticity

** Diagnostics for Spatial Dependence

The coefficient estimates for *W_ECON_00, F1, F3, MEDAGE, LNRACE, ECON_90, EDUC_90, HOUS_90* and the intercept of the spatial lag model for the 2000 economic opportunity dimension index (*ECON_00*) are highly significant. The coefficient estimates for *LNNATINC* and *LNGRAV* are significant at a 10% level. The coefficient estimate of *F2* is not statistically significant in the *ECON_00* spatial lag model. *W_ECON_00, F1, F3, LNNATINC, MEDAGE,* and *ECON_90* have significant positive effects on *ECON_00*. *LNRACE*, *EDUC_90*, and *HOUS_90* have a significant negative effects on *ECON_00*.

The coefficient estimates for *W_EDUC_00, F1, F3, LNRACE, EDUC_90, HOUS_90,* and the intercept of the spatial lag model for the 2000 education dimension index (*EDUC_00*) is highly significant. The variables *F2, LNNATINC, MEDAGE*, and *LNGRAV* do not have statistically significant effects on *EDUC_00*. *W_EDUC_00, F3, LNRACE* and *EDUC_90* have significant and positive effects on *EDUC_00*. *F1*, *ECON_90*, and *HOUS_90* have significant negative effects on *EDUC_00*.

The coefficient estimates for *W_EDUC_00, F1, F3, MEDAGE, ECON_90, EDUC_90, HOUS_90, LNGRAV*, and the intercept of the spatial lag model for the 2000 housing dimension index (*HOUS_00*) are significant. The coefficient estimate for *LNRACE* is significant at a 10% level. *F2* and *LNNATINC* do not have statistically significant effects on *HOUS_00*. *W_HOUS_00, F1, F3,* and *HOUS_90* have significant and positive effects on *HOUS_00*. *MEDAGE, LNRACE, ECON_90*, and *EDUC_90* have significant and negative effects on *HOUS_00*.

The coefficient estimates for *W_F3, F1, F2, LNRACE, ECON_90, EDUC_90, HOUS_90*, and the intercept of the spatial lag model for the 2000 social development

factor (*F3*) are highly significant. The coefficient estimate for *MEDAGE* is significant at a 5% level. *LNNATINC* and *LNGRAV* do not have statistically significant effects toward *HOUS_00*. *W_F3, F1, F2, MEDAGE, ECON_90, EDUC_90,* and *HOUS_90* have significant and positive effects on *F3*. *LNRACE* has a significant negative effect on *F3*.

The predicted coefficient estimates of the spatial lag model for *ECON_00*, *EDUC_00*, and *HOUS_00* versus their actual values are visualized in Figure 5.91 to Figure 5.92. The predicted coefficient estimates of the spatial lag model for *F3* versus the predicted coefficient estimate of the 2000 social development factor measurement model are illustrated in Figure 5.23.

The actual versus predicted dependent variables from the spatial lag models for the 2000 social development matched well in the maps. Although the predicted values are underestimated slightly in the overall models, the counties with the highest (or higher, medium, lower, lowest) predicted values are also generally in the highest (or higher, medium, lower, lowest) categories in actual values of the variables. Therefore, the spatial lag models for the 2000 social development appear to be highly accurate. The counties in the MSAs and urban 4 & 5 counties appear to have a higher social development level, along with neighboring counties associated with the large cities, based on Figure 5.93. However, characteristics for each variable are different for the rural/urban differences. Urban 6 & 7 and some rural areas have a lower social development level. Coastal counties have high 2000 social development. The strengths of influencing exogenous variables are reported in Table 5.23.

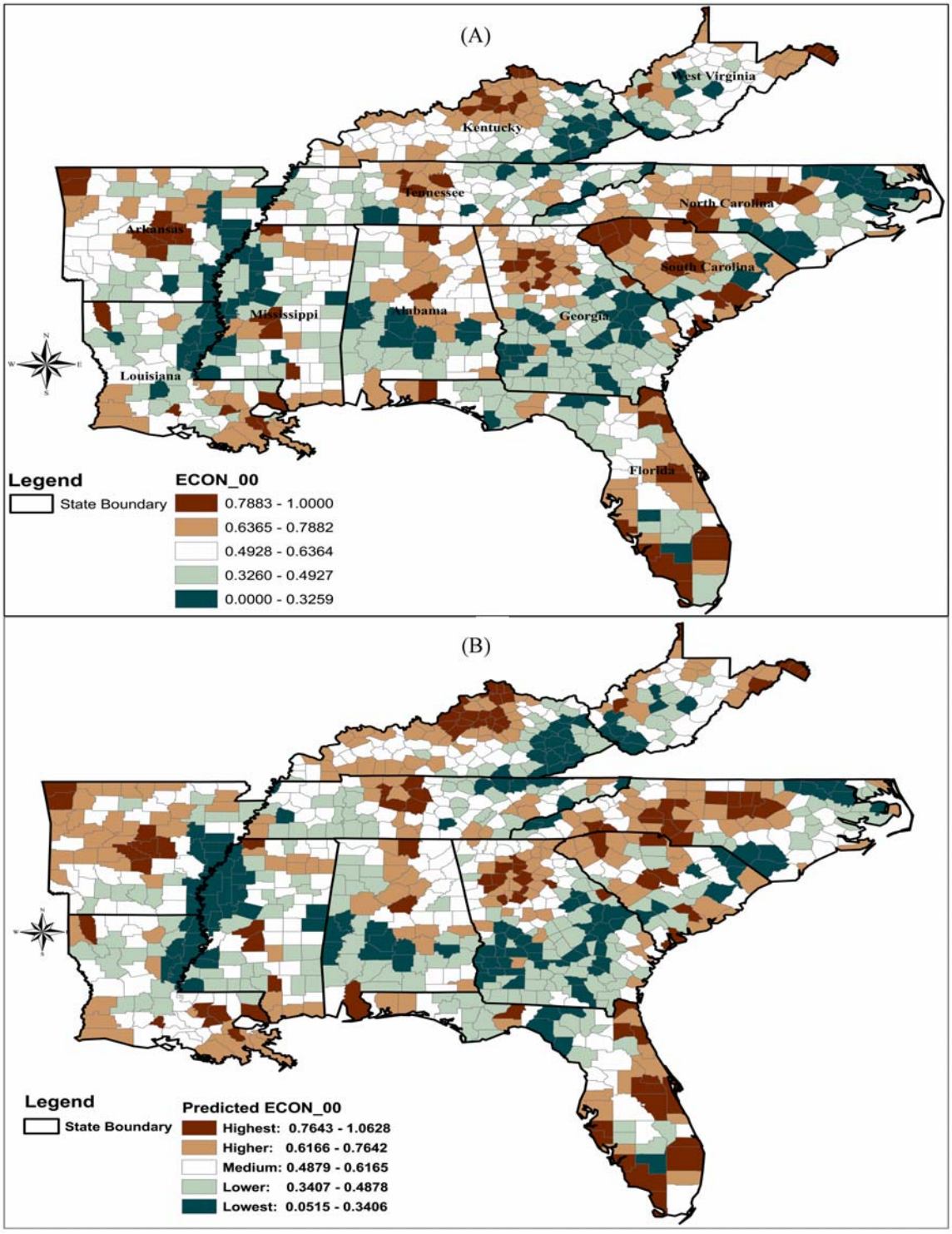

Figure 5.91 Actual *ECON_00* vs. Predicted *ECON_00* from the Spatial Lag Model

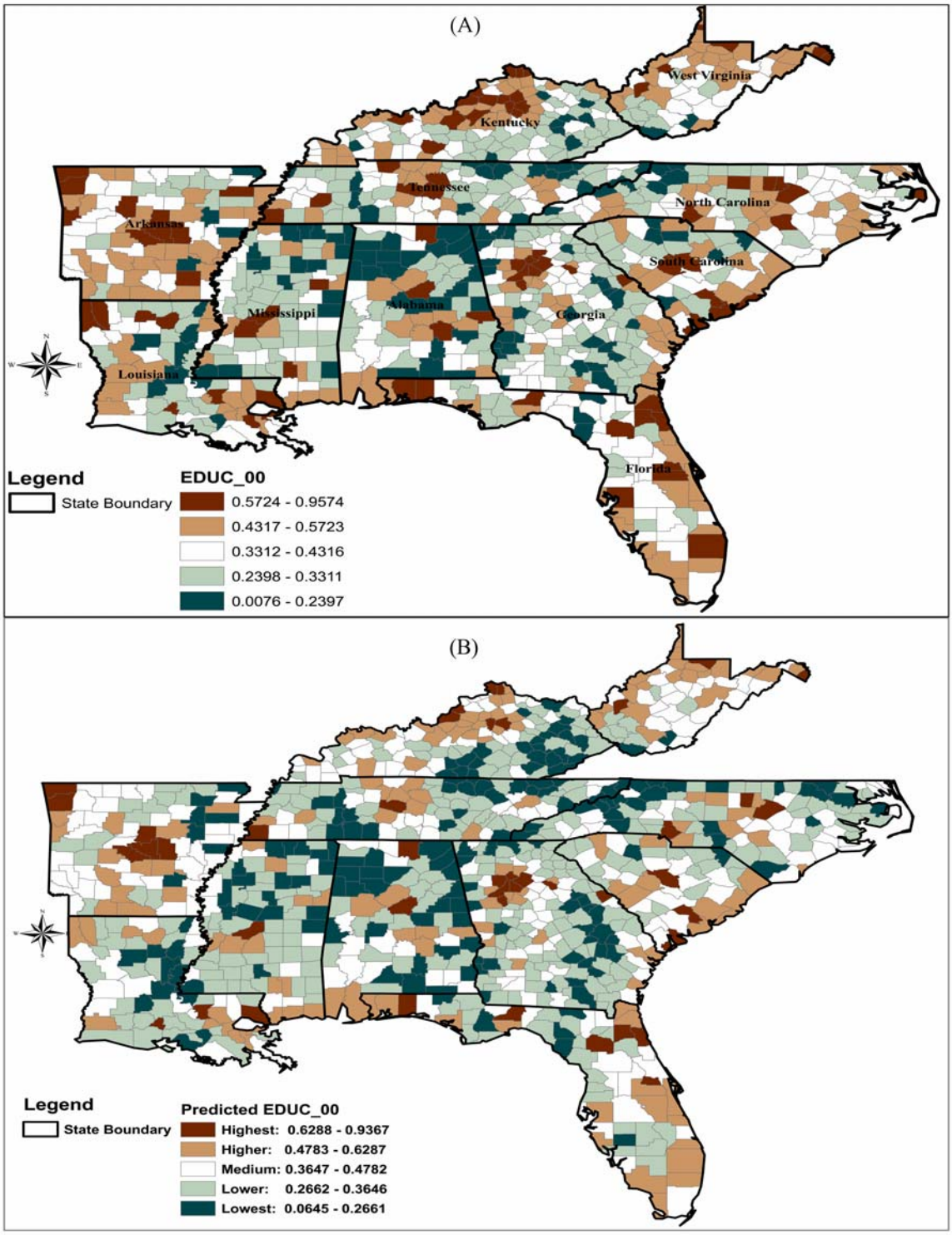

Figure 5.92 Actual *EDUC_00* vs. Predicted *EDUC_00* from the Spatial Lag Model

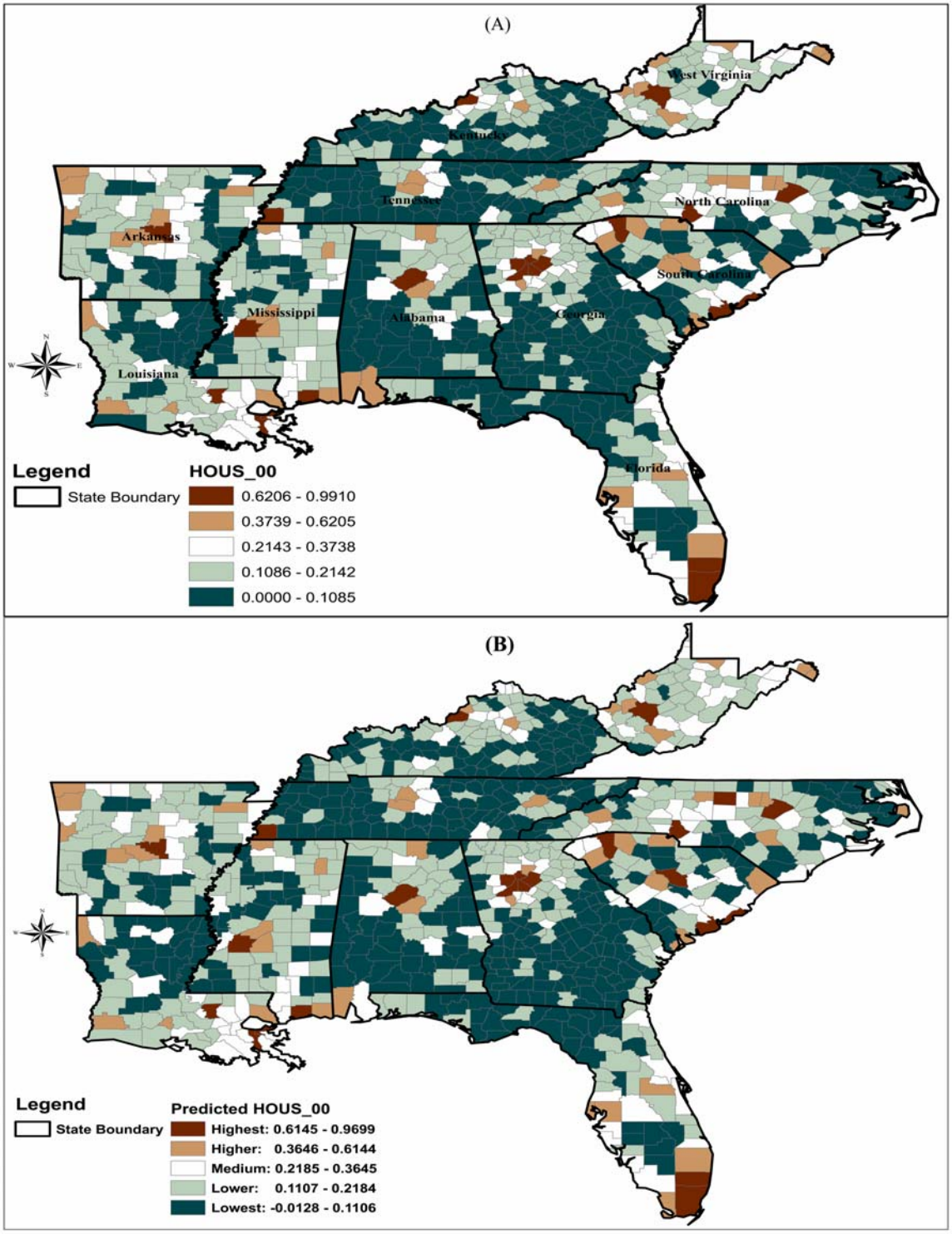

Figure 5.93 Actual *HOUS_00* vs. Predicted *HOUS_00* from the Spatial Lag Model

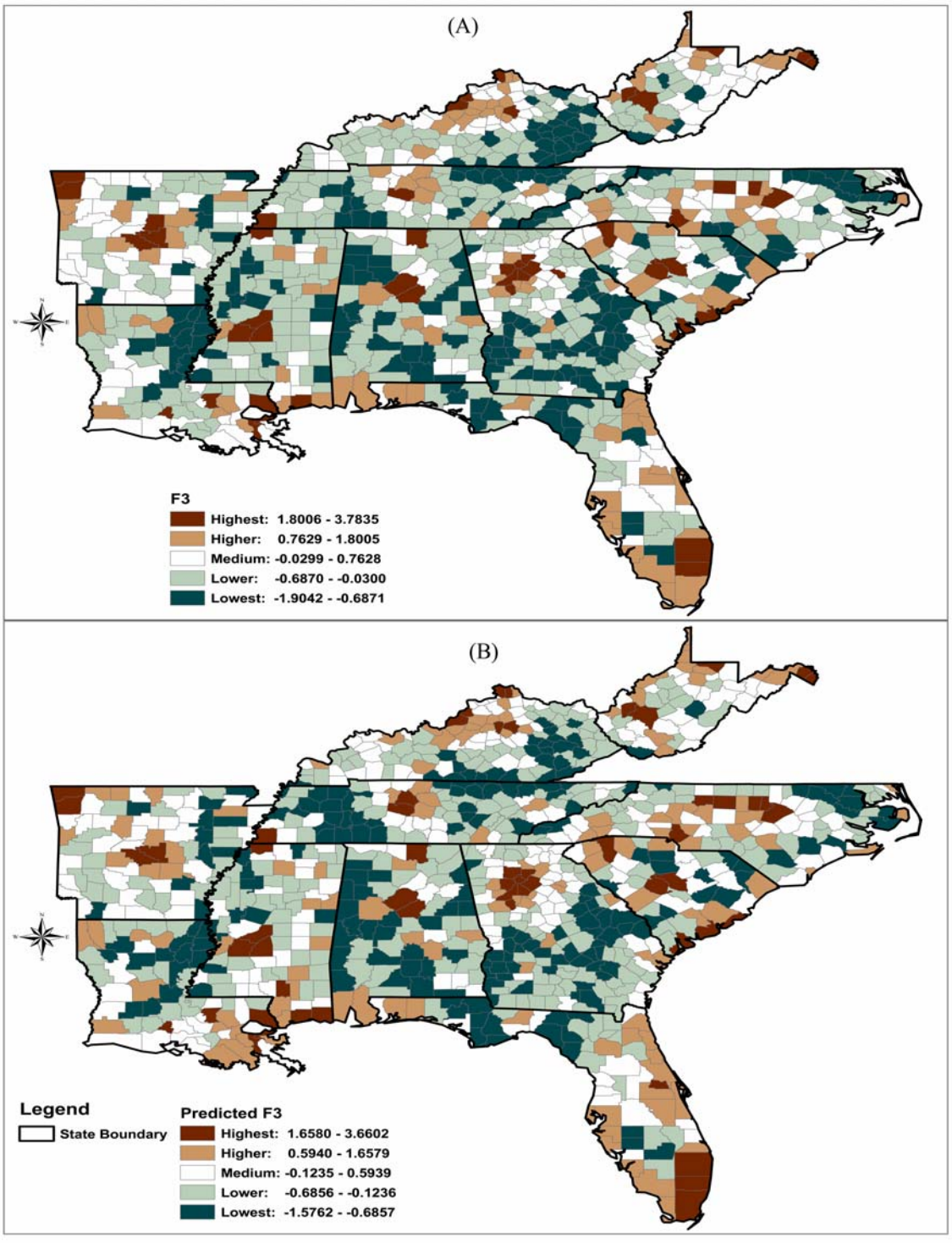

Figure 5.94 Predicted *F3* from the Social Development Measurement Model vs. Predicted *F3* from the Spatial Lag Model

5.4.4 Summary of Spatial Lag Models

The spatial lag model for economic growth, population growth, and the 2000 social development were estimated through maximum likelihood estimation methods in GeoDa 0.9^{e}. The result suggests that the neighborhood effect is strongly significant toward economic growth (1995 – 2000), population growth (1995 – 2000), and the 2000 social development. Population growth and economic growth have interdependent relationships among each other. Economic growth and population growth have positive effects on the 2000 social development. The spatial lag variables for each model are significant, except for *EMPGRO*, which means the neighborhood effects on the county are strong – economic growth, population growth, and the 2000 social development characteristics of a county all have strong spatial dependence. A majority of the explanatory/exogenous variables have significant effects on economic growth, population growth, and social development.

Maps for the predicted values of the dependant variables match the actual values of corresponding variables quite closely. This suggests that the predicted values of the spatial lag models are an excellent fit with the data. From the maps, the positive significant clusters are shown, where the hot spots (high-high) and cold spots are visible.

CHAPTER VI

CONCLUSIONS AND FUTURE WORK

6.1 Conclusions

The research presented in this study has been primarily geared to investigate how county level population growth, economic growth, and localized social structure are interrelated and spatially distributed in the Southeast[1] Region of the United States during the period of 1995-2000. After compiling an extensive dataset, exploring the dataset using collective techniques and approaches, and building many different types of statistical, econometrics, and spatial econometrics models, the following conclusions are made based on results of this research. The structural equation modeling results suggest that (The results for the overall Southeast, United States, are illustrated in Table 6.1 and 6.2):

1) There is a statistically significant positive interdependent relationship between the economic growth factor and the population growth factor from 1995 to 2000 for the Southeast. The direct effect of the economic growth on the population growth is stronger than direct effect of the population growth on the economic growth. The feedback effect or indirect effect of economic growth factor through the

[1] According to the regions classification of Bureau of Economic Analysis, the Southeast Region consists of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia. Virginia is not included in this study because of its unique city-county configurations and the fact that such data incontinuities are more likely to lead to ambiguity than clarification.

population growth factor on the economic growth factor and indirect effect of the population growth factor through the economic growth factor on the population growth factor are statistically significant positive effects. The differences between rural and urban areas, as well as the differences between coastal and non-coastal areas, do not influence the characteristics (signs) of this interdependent relationship but do influence the magnitude of the interdependent relationship. This work extends and confirms Mead's work (A Simultaneous Equations Model of Migration and Economic Change in Nonmetropolitan Areas (1982)) and others (for example: (Al-Dakhil, Khalid I., 1997, Campbell, Charles A, 1985, Franklin, Rachel 2003, Greenwood, Michael J., 1975a, b, 1976, Greenwood, Micheal J. and Gary L. Hunt, 1984, Greenwood, Michael J., Gary L. Hunt and John M. McDowell, 1986, Herzog, Henry W. and Alan M. Schlottmann, 1982, Herzog, Henry W., Alan M. Schlottmann and Donald L. Johnson, 1986, Muth, Richard F., 1970, Schlottmann, Alan M. and Henry W. Herzog, 1982, 1984), etc. that indicate there is a significant link between the patterns of economic and demographic change within nonmetropolitan areas. It also supports Mead's contention that migration both affects, and is affected by, employment and income growth.

2) The total effect of the economic growth factor from 1995 to 2000 on the social development factor for 2000 is statistically significant and positive for the Southeast. However, the signs of the direct and indirect effects (through the population growth factor) of the economic growth factor on the 2000 social development factor depend on the rural/urban and coastal/non-coastal differences. The direct effect of the economic growth factor on 2000 social development

factor for counties in the metropolitan statistical areas and the indirect effect of economic growth factor on 2000 social development factor for coastal counties are statistically significant negative effects. Krugman (1991) stated that the role of cities during the nineteenth century was important in economic growth and development. This study argues that large cities are important for agglomeration, or clustering, but economic growth tends to be concentrated in the neighboring counties of a county with a large city, rather than in the county of the large city. This supports the findings of Glaeser (2000) that traditional urban benefits have declined because, with decreased transport costs, manufacturers have departed from city areas (Glaeser, Edward L., 2000). Another possible explanation would be that if large cities or counties in MSAs have economic growth, the costs of living in the large cities and counties in MSAs are expensive, especially for housing. Therefore, people will work in the MSA or large cities but live in the neighboring counties of the large cities where expenses are relatively cheaper. For coastal counties, economic growth stimulates population growth; however, when population growth is rapid, it tends to have a negative effect on social development because of higher unemployment and more expensive housing caused by such rapid population growth.

3) The total effect of the population growth factor (from 1995 to 2000) on the social development factor for 2000 is statistically significant and positive for the Southeast. The rural and urban difference does not influence the outcome of population growth on 2000 social development, but coastal and non-coastal differences do influence the effect of population growth on 2000 social

development. The total and direct effects of the population growth on 2000 social development are both statistically significant and negative.

4) Exogenous variables of demographic characteristics (median age, the ratio of the number of births to the number of deaths, and the ratio of number of nonwhites to the number of whites) and urban transition characteristics (gravity into the large cities) have statistically significant effects on economic growth, population growth, and social development factors and on endogenous variables, based on the SEM II-B model results. The effects of exogenous variables on the endogenous variables and the latent variables depend on the rural/urban and the coastal/non-coastal differences. Since SEM II-A model does not fit the data well, the effect of the 1990 social development level on the economic growth, the population growth, and 2000 social development level cannot be concluded.

Table 6.1 Results of Full Structural Equation Model I-A (SEM I-A) for the Southeast

Latent Variables	Effects	Endogenous Variables											
		Economic Growth Indicators			Population Growth Indicators			Social Development Indicators			Factors / Latent Variables		
		PINCGRO	*EMPGRO*	*ESTGRO*	*LNDENGRO*	*LNOMRR*	*LNIMRR*	*HOUS_00*	*EDUC_00*	*ECON_00*	*F1*	*F2*	*F3*
F1 Economic Growth Factor	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	+	+	+	0	0	0	0	0	0	0	+	+
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
F2 Population Growth Factor	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	+	+	+	0	0	0	+	0	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
F3 Social Development Factor	Total	NA	NA	NA	NA	NA	NA	+	+	+	NA	NA	NA
	Direct	NA	NA	NA	NA	NA	NA	+	+	+	NA	NA	NA
	Indirect	NA	NA	NA	NA	NA	NA	0	0	0	NA	NA	NA

Note: Reject H_o for the total effect of *F1* on *LNOMRR*

Table 6.2 Results of Full Structural Equation Model II-B (SEM II-B) for the Southeast

Exogenous Variables	Effects	Endogenous Variables											
		Economic Growth Measurements			Population Growth Measurements			Social Development Measurements			Factors / Latent Variables		
		PINCGRO	*EMPGRO*	*ESTGRO*	*LNDENGRO*	*LNOMRR*	*LNIMRR*	*HOUS_00*	*EDUC_00*	*ECON_00*	*F1*	*F2*	*F3*
NATINC	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	0	0	0	0	0	0	+	+	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
MEDAGE	Total	+	+	+	+	+	+	+	+	+	+	+	+
	Direct	0	0	0	0	0	0	0	0	0	+	+	-
	Indirect	+	+	+	+	+	+	+	+	+	+	+	+
LNRACE	Total	-	-	-	-	-	-	-	-	-	-	-	-
	Direct	0	0	0	0	0	0	0	0	0	-	-	-
	Indirect	-	-	-	-	-	-	-	-	-	-	-	-
ECON_90	Total	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Direct	0	0	0	0	0	0	0	0	0	NS	NS	NS
	Indirect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
EDUC_90	Total	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Direct	0	0	0	0	0	0	0	0	0	NS	NS	NS
	Indirect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
HOUS_90	Total	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Direct	0	0	0	0	0	0	0	0	0	NS	NS	NS
	Indirect	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LNGRAV	Total	-	-	-	-	-	-	+	+	+	-	-	+
	Direct	0	0	0	0	0	0	0	0	0	-	-	+
	Indirect	-	-	-	-	-	-	+	+	+	-	-	+

Note: Reject H_o for the direct effect of *LNRACE* on *F2* and effects of *LMGRAV* on all endogenous variables and *F1*, *F2*, *F3*.

[1] Null hypotheses for latent variables effects on endogenous variables are same as Full Structural Model I in Table 1.5. Therefore only null hypotheses for exogenous variables on endogenous variables are included.

GIS raster modeling based on the results of the structural equation models suggest that the actual endogenous variables versus the predicted endogenous variables from SEM II-B and the predicted factors of economic growth, the population growth, and 2000 social development from the corresponding measurement model versus predicted factors of each factors from the corresponding SEM II-B generally match as expected, which demonstrates the strength of the structural equation model and raster model.

Another main task of this research was to determine the spatial distribution of the county level population growth, economic growth, and localized social structure in the southeast region of the United States during the period of 1995-2000. The results of hierarchical cluster analysis, spatial autocorrelation, and spatial lag model suggest there are statistically significant homogenous clusters and statistically significant positive spatial autocorrelation or spatial dependence. Positive Moran's I and spatial lag variables of dependent variables are significant except for the average annual rate change in the number of people employed. The positive significant clusters are shown where the hot spots (high-high) and cold spots (low-low) are visible. High-high, which means the observation county and its surrounding counties have a statistically significant high values/characteristics in terms of economic growth, population growth, and social development, and low-low is vise versa. Figures 6.1 – 6.6 show the results of the LISA maps in context of rural/urban and coastal/non-coastal differences and city and university influences for the overall Southeast.

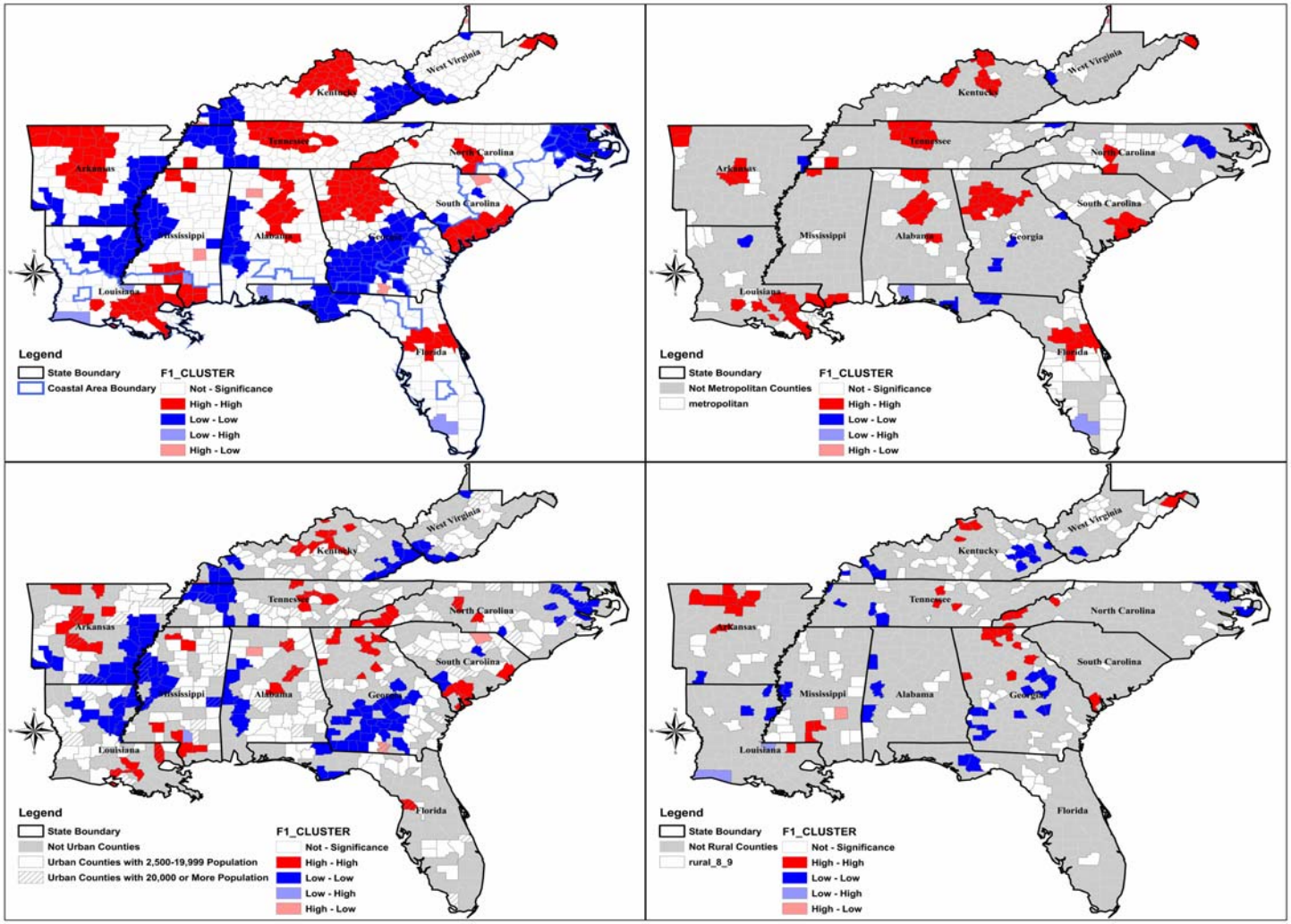

Figure 6.1 LISA Cluster Map for the Economic Growth Factor of Southeast by Rural/Urban and Coastal/Non-Coastal Differences

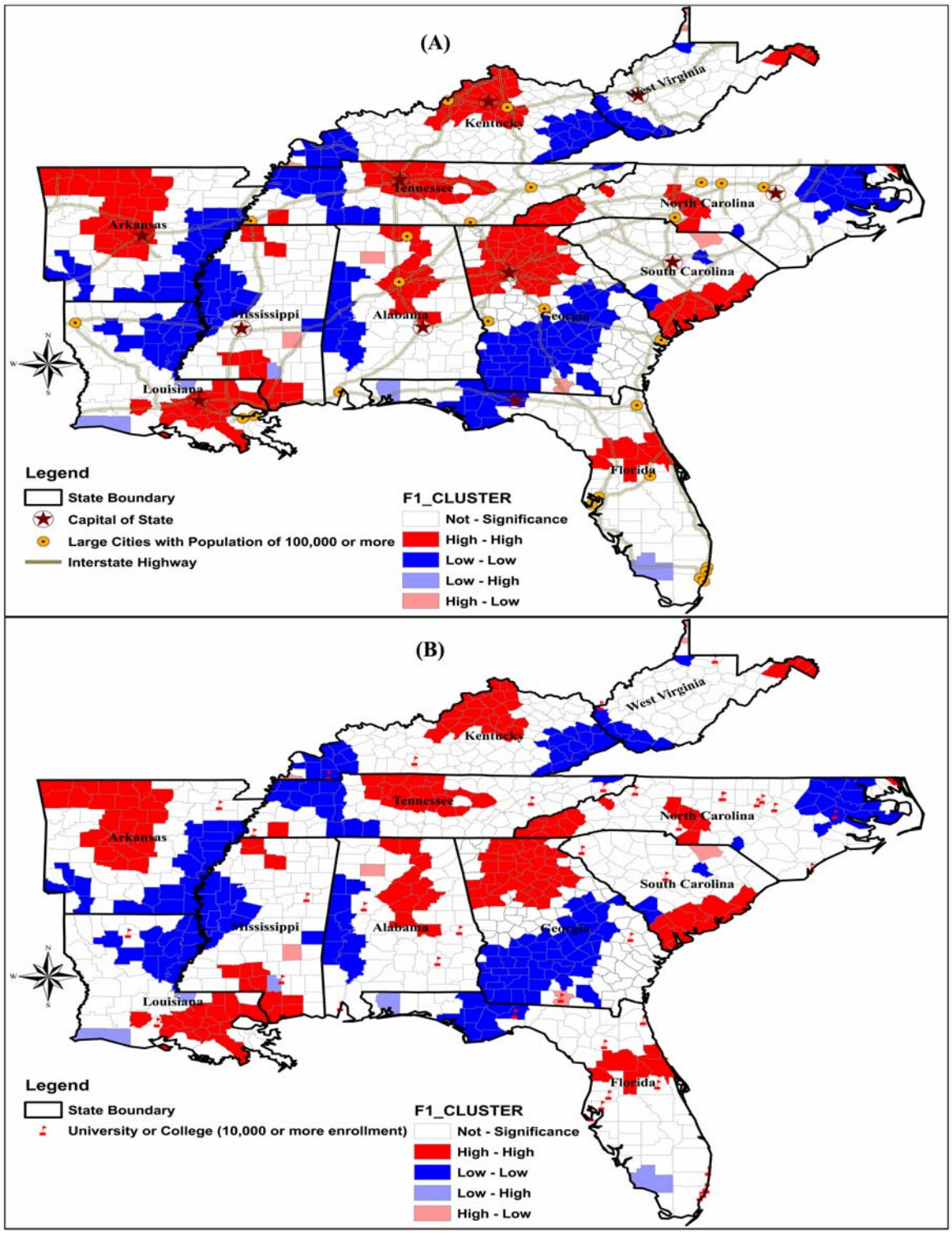

Figure 6.2 Large Cities, Interstate Highways, and Large Universities Influences on the LISA Cluster Map for the Economic Growth Factor of the Southeast

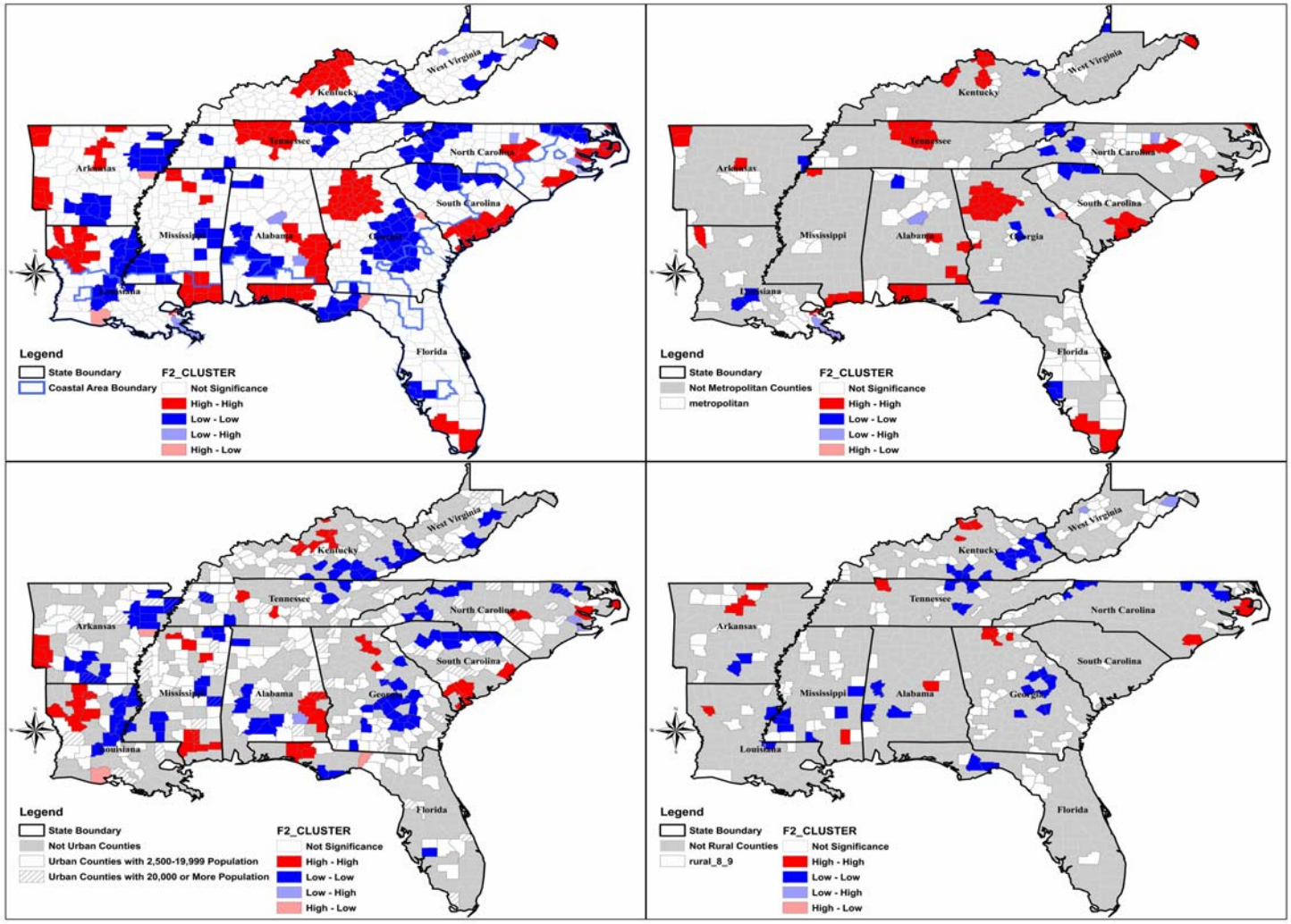

Figure 6.3 LISA Cluster Map for the Population Growth Factor of Southeast in by Rural/Urban and Coastal/Non-Coastal Differences

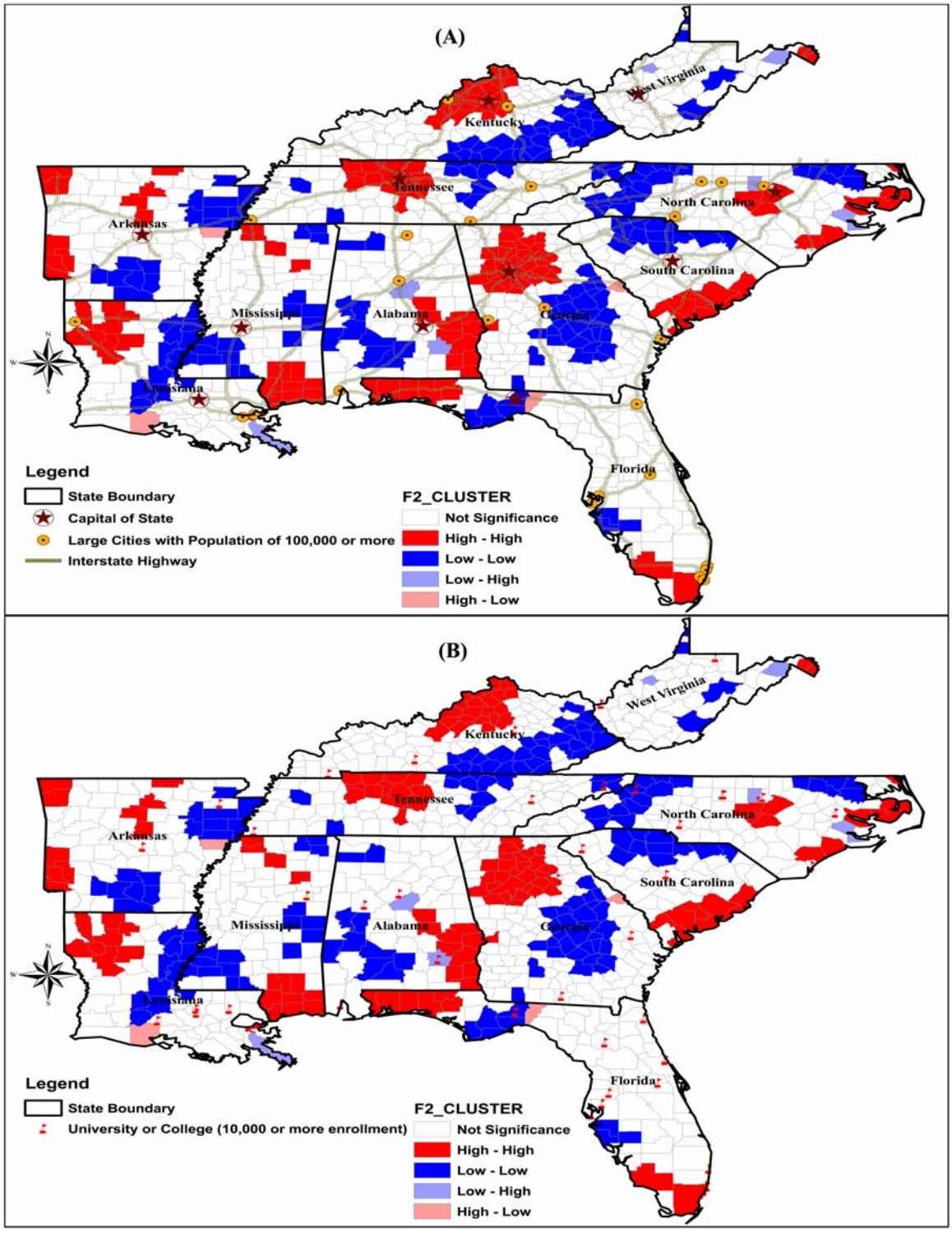

Figure 6.4 Large Cities, Interstate Highways, and Large Universities Influences on the LISA Cluster Map for the Population Growth Factor of the Southeast

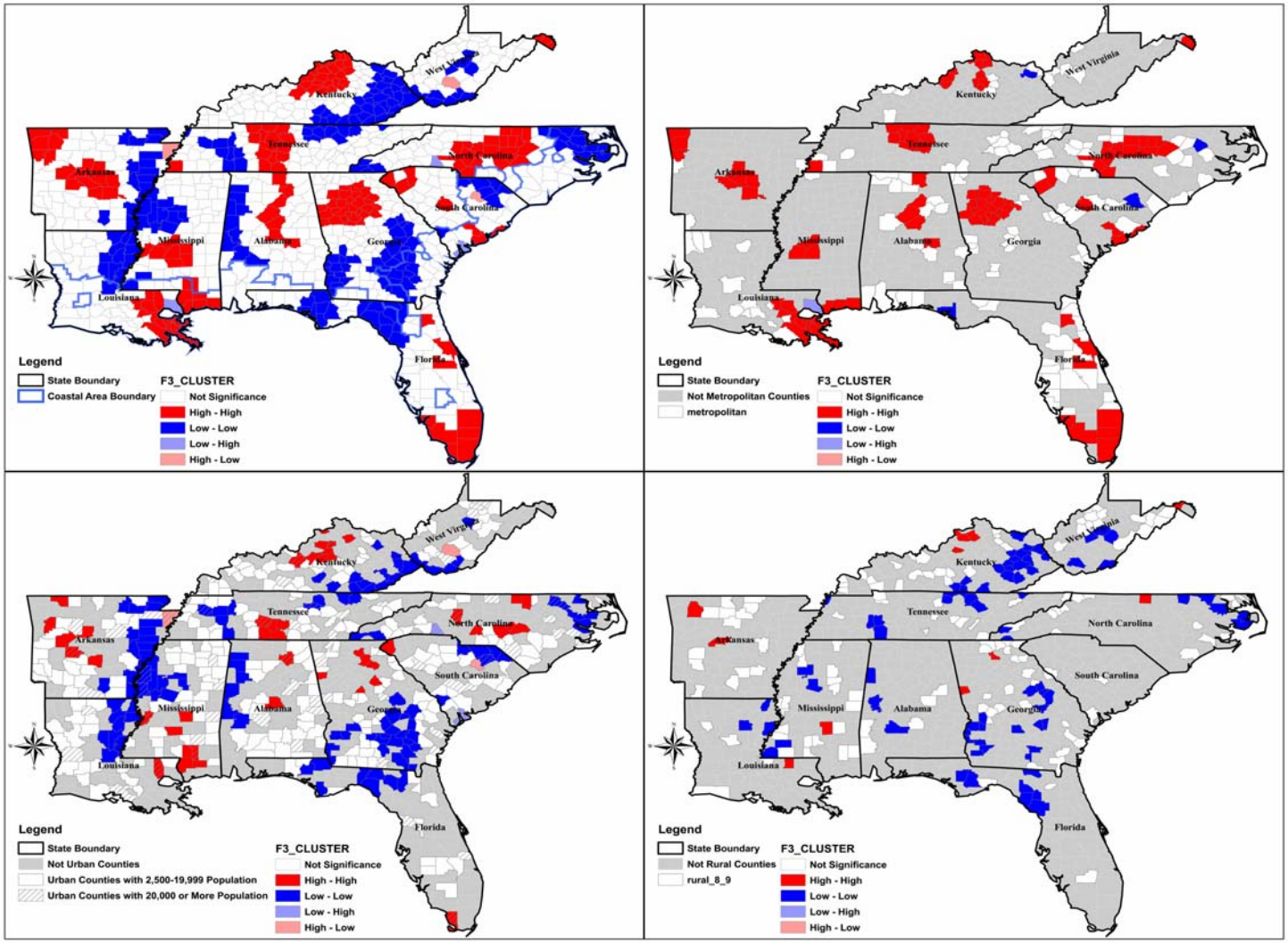

Figure 6.5 LISA Cluster Map for the 2000 Social Development Factor of Southeast in by Rural/Urban and Coastal/Non-Coastal Differences

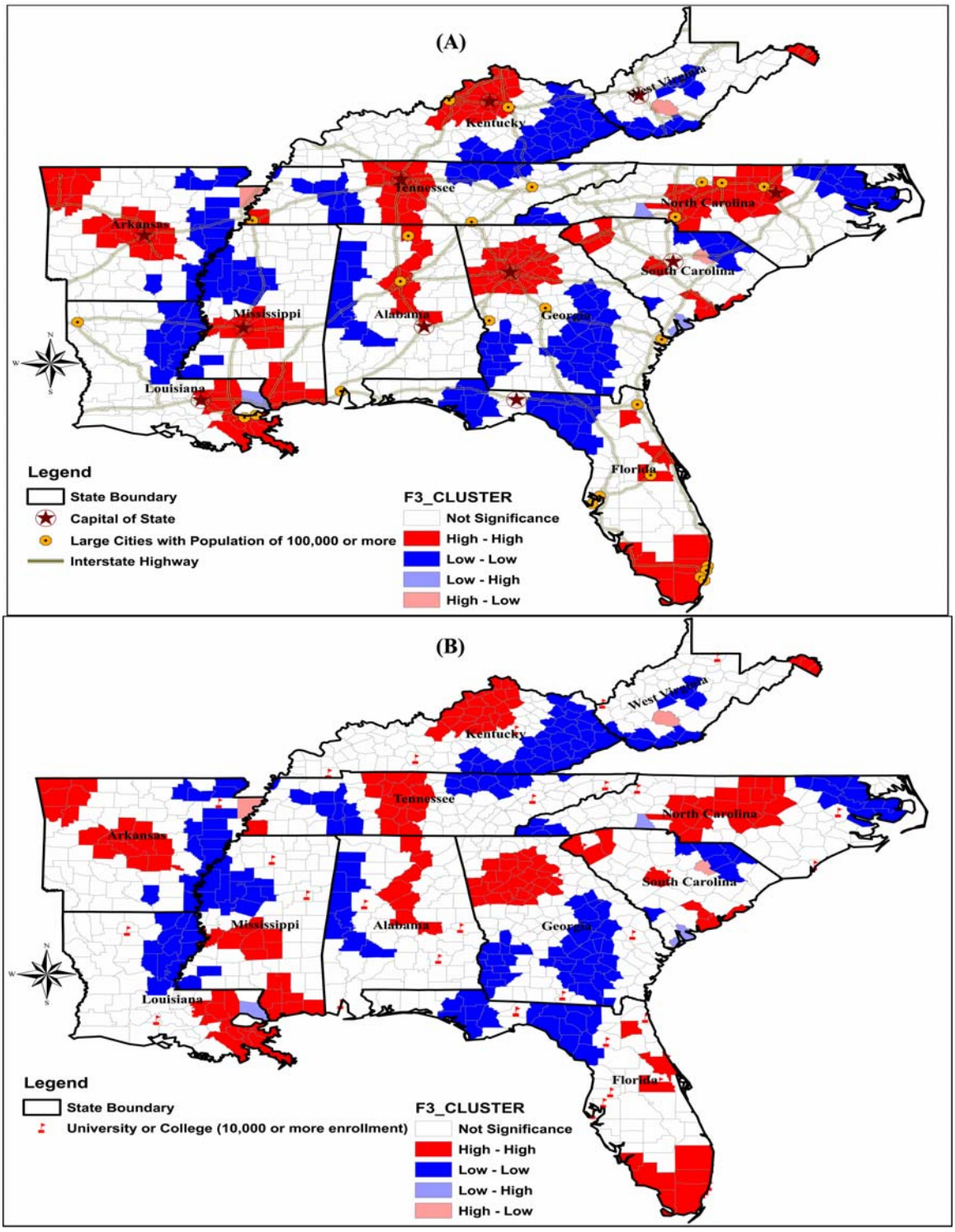

Figure 6.6 Large Cities, Interstate Highways, and Large Universities Influences on the LISA Cluster Map for the 2000 Social Development Factor of the Southeast

Hot spots are usually shown in surrounding counties of a county with a large city (more than 100,000 population), but for most cases, the county with the large city is not actually part of the hot spot. These surrounding counties are generally the counties in MSAs and adjacent urban 4 & 5 counties, few adjacent urban 6 & 7 counties, or adjacent rural 8 & 9 counties. Counties that were close to interstate highways usually have hot spots in population growth (1995-2000), economic growth (1995-2000), and 2000 Social development. Although the universities with more than 10,000 enrollment have significant effects on economic growth, the population growth, and the 2000 social development of the corresponding counties, the universities did not have any effect on creating statistically significant high-high (high value surrounded by high value) clusters or high-low (high value surrounded by low value) clusters. Cold spots in the economic growth, the population growth, and 2000 social development are normally found for counties that are far from the interstate highways and large cities, mainly urban 6 & 7 counties and rural 8 & 9 counties. Such cold spots are seen in West Virginia, Kentucky, northern Arkansas, southern Georgia, and northeastern Tennessee. Racial composition has a strong role on the spatial distribution of the economic growth, the population growth, and the social development level. If clustering counties have a majority of nonwhite population (except Florida), then these clustering counties become cold spots- an example demonstrated in the Delta area. Coastal phenomena also have a significant role for statistical significant clusters. Counties with substantial damage from hurricanes were found to be cold spots; otherwise, coastal characteristics appear to be pull factors for the population growth. Rapid increase in population growth in the coastal counties tends to lead to negative impacts on social development.

Each method in itself offers many suggestions on where the high socioeconomic development is located and other useful information to answer the proposed hypotheses formulated in Chapter I.

6.2 Contributions

A contribution of this research is the statistical and spatial variation of the socioeconomic development, particularly the relationship between economic growth and population growth, and the social development examined in the context of urban and rural differences, and coastal and non-coastal differences. The relevance of these differences has become more important in light of Katrina and other recent hurricanes. Understanding such differences can help lead to an understanding of both the impacts of such disasters and how recovery may be affected by such factors.

Another contribution of this research is that the study employs a collection of tools, techniques, and modeling, including not only traditional tools, such as descriptive statistics analysis or mapping, but also hierarchal cluster analysis, spatial statistics and spatial econometric analysis, structural equation modeling, and GIS modeling. These tools are infrequently employed in the field of economics. These tools are relatively new to the field of economics but are important, so it is beneficial to demonstrate such new methods/tools, which will hopefully be used for future research. Traditional methods are usually solely quantitative and rarely attempt to recognize interdependencies or latent variables. Adding these new tools help to show the importance of such interdependcies and illustrate a realistic visual perspective on hypothesized questions, conclusions, data, and results. Hierarchal cluster analysis and spatial cluster analysis help further the

advancement in the field of economics study. This study will hopefully help lessen the wide gap between the field of economics and the complex environment of available tools that can provide better analysis and better visual illustrations and that allow a more comprehensive understanding of population growth and economic growth studies.

Although there are many studies in the interdependent relationship between population growth and the economic growth, this appears to be the first study that demonstrates that an interdependent relationship between population and economic growth actually affects social development.

The final contribution of this study is that it has employed the structural equation modeling tool. The majority of the studies investigating the interdependence relationship between the population growth and the economic growth employ the simultaneous equation modeling approach. The simultaneous relationship between population growth and economic growth on overall socioeconomic development in a regression analysis can cause simultaneity, endogeneity, and heteroscedasticity problems, using the given data information. An advantage of structural equation modeling is its emphasis on covariances rather than individual cases. Individual cases that are outliers can be a problem in parameter estimation. Structural equation modeling minimizes the differences between the residuals and the difference between sample and predicted covariances.

Structural equation model allows the use of latent variables. Latent variables, variables which are not measured directly, are estimated in the model from measured variables which are assumed to 'tap into' the latent variables. This allows the modeler to

explicitly capture the unreliability of the measurement in the model, allowing the structural relations between latent variables to be accurately estimated.

The results of the structural equation models provide a decomposition of the direct and indirect effects of each exogenous variable on the endogenous variables. Demonstrating the usefulness of the structural equation model is a contribution to the literature of the simultaneous studies of the economic growth and the population growth studies.

6.3 Limitations

This study has several minor limitations. None of them should be considered major impediments.

Limitations in the dataset: This study excludes Virginia in the models because county and city level data are mixed, and much of this dataset is from multiple institutions, some of which do not use the same concept; therefore, it is difficult to construct information for equivalent counties. Internal migration data is cross-sectional data that is collected every five years from the current population survey; therefore, it is not an annual time series data.

Limitations in the analysis: If the results of structural equation model are compared to the results of 2SLS estimator of the latent variable SEM model, conclusions and results would be more reliable. EQS software does not have the capability to estimate 2SLS. However, the ML estimator is more efficient than 2SLS given its simultaneous estimation of all relationships; hence ML, will dominate 2SLS in sufficiently large samples if all assumptions are valid. The spatial lag model has

heteroscedasticty problems; future work to improve the model should be implemented using a two stage least square method. GeoDa also does not have the capability to estimate 2SLS, so another tool will have to be found or constructed.

6.4 Future Work

The population growth factor incorporates both the average annual rate of change in population density and average annual rate of change in the number of net migration. This can improve the goodness of fit of the structural equation model.

Hurricanes and other natural disasters have produced impacts on socioeconomic development including economic growth, population growth, and social development. Such impacts are not measured in this study. Future studies using these techniques will improve the measurement of these kinds of impacts.

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APPENDIX A

DESCRIPTIVE STATISTICS FOR ALL VARIABLES BY STATE

Table A.1 Average Real per Capita Personal Income and Its Average Annual Rate of Change, by State and RUC, 1995 - 2000

State by RUC	No of Counties	Average Per Capita Personal Income in 2000 dollar value						PINCGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	19409	19844	20380	21016	21311	21632	1.0213
Metro	250	22810	23282	23923	24912	25308	25872	1.0249
Urban 4 & 5	62	21247	21578	22174	22950	23166	23511	1.0199
Urban 6 & 7	397	18380	18754	19230	19751	19990	20155	1.0183
Rural	221	16896	17428	17935	18338	18643	18962	1.0230
Alabama	67	19424	19518	19962	20646	20989	20929	1.0149
Metro	21	21957	22146	22629	23464	23710	23906	1.0169
Urban 4 & 5	6	19711	19640	20123	20996	21227	21288	1.0157
Urban 6 & 7	32	18317	18404	18801	19410	19840	19598	1.0135
Rural	8	16990	16988	17487	17934	18262	18167	1.0143
Arkansas	75	18528	19036	19447	19916	20176	20016	1.0153
Metro	11	21177	21705	22071	22928	23365	23605	1.0216
Urban 4 & 5	6	20471	20927	21283	21778	22026	22172	1.0158
Urban 6 & 7	42	18362	18864	19253	19667	19814	19519	1.0121
Rural	16	16414	16941	17466	17801	18240	18043	1.0193
Florida	67	21843	22311	22927	24035	24528	24843	1.0247
Metro	34	25238	25850	26547	27857	28416	29097	1.0285
Urban 4 & 5	3	28367	29116	30212	31962	32553	33699	1.0344
Urban 6 & 7	20	17976	18261	18636	19512	19876	19762	1.0191
Rural	10	16077	16334	17018	17704	18203	17883	1.0203
Georgia	159	20007	20601	20878	21545	22020	22229	1.0205
Metro	42	22857	23623	23998	24991	25547	26129	1.0260
Urban 4 & 5	7	21302	21940	22279	23038	23236	23639	1.0213
Urban 6 & 7	66	19049	19583	19864	20390	20799	20872	1.0181
Rural	44	18520	19029	19200	19752	20291	20319	1.0186
Kentucky	120	18012	18557	19259	19817	20048	20976	1.0305
Metro	22	22012	22653	23572	24599	25068	26083	1.0343
Urban 4 & 5	4	23161	23626	24408	25421	25870	26686	1.0290
Urban 6 & 7	51	17861	18319	18939	19458	19548	20438	1.0272
Rural	43	15665	16271	16952	17274	17530	18469	1.0326

Table A.1 (continues) Average Real per Capita Personal Income and Its Average Annual Rate of Change, by State and RUC, 1995 - 2000

State by RUC	No of Counties	Average Per Capita Personal Income in 2000 dollar value						PINCGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	18725	19054	19502	19952	19956	19893	1.0114
Metro	24	21152	21377	22099	22951	22721	23009	1.0167
Urban 4 & 5	5	18383	18683	19507	20215	19910	20040	1.0174
Urban 6 & 7	27	17348	17677	17815	17935	18127	17778	1.0045
Rural	8	16309	16966	17402	17595	17863	17597	1.0153
Mississippi	82	17309	17894	18395	18917	19013	19134	1.0198
Metro	7	22283	22655	23362	24826	25085	25634	1.0281
Urban 4 & 5	8	19888	20247	20856	21484	21557	21682	1.0172
Urban 6 & 7	43	17207	17684	18201	18758	18856	18991	1.0197
Rural	24	15183	16099	16473	16623	16674	16646	1.0183
North Carolina	100	21426	22007	22874	23516	23736	24380	1.0259
Metro	35	23872	24389	25319	26353	26782	27438	1.0279
Urban 4 & 5	8	21156	21633	22334	22987	22979	23517	1.0212
Urban 6 & 7	35	20529	21073	21878	22330	22524	23112	1.0240
Rural	22	19059	19837	20766	21080	21095	21846	1.0275
South Carolina	46	19599	20004	20692	21470	21950	22376	1.0265
Metro	16	21646	21970	22585	23478	24091	24743	1.0268
Urban 4 & 5	4	21999	22589	23700	24498	25085	25418	1.0281
Urban 6 & 7	23	18021	18410	19121	19824	20178	20428	1.0253
Rural	3	17579	18286	18627	19339	19928	20628	1.0325
Tennessee	95	20074	20164	20745	21356	21767	22152	1.0199
Metro	26	23249	23464	24048	24878	25411	25923	1.0219
Urban 4 & 5	7	22548	22276	22571	23309	23728	23862	1.0118
Urban 6 & 7	40	19116	19126	19740	20261	20583	20845	1.0176
Rural	22	17277	17481	18088	18564	18991	19526	1.0242
West Virginia	55	17901	18171	18621	19229	19315	19715	1.0193
Metro	12	21347	21699	22247	22976	23096	23655	1.0208
Urban 4 & 5	4	20821	21062	21562	22355	22678	23275	1.0225
Urban 6 & 7	18	16992	17133	17544	18154	18099	18347	1.0157
Rural	21	16156	16494	16913	17413	17556	17958	1.0209

Table A.2 Average Number of People Employed and Its Average Annual Rate of Change, by State and RUC, 1995 - 2000

State by RUC	No of Counties	Average of the Total Number of People Employed						EMPGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	28702	29347	30023	30569	31085	31539	1.0153
Metro	250	77007	79088	81236	83172	84864	85733	1.0234
Urban 4 & 5	62	30906	31350	31836	31997	32161	32437	1.0077
Urban 6 & 7	397	11449	11550	11673	11703	11785	12117	1.0096
Rural	221	4433	4488	4543	4555	4616	4871	1.0184
Alabama	67	29192	29741	30375	30736	30899	30938	1.0087
Metro	21	64177	65765	67475	68753	69400	68543	1.0173
Urban 4 & 5	6	28314	28544	29170	29010	28906	30518	1.0074
Urban 6 & 7	32	12422	12516	12617	12583	12529	12716	1.0016
Rural	8	5092	4976	4926	4848	4809	5429	1.0152
Arkansas	75	15608	15720	15695	15725	15974	16046	1.0043
Metro	11	51447	52150	52316	52646	53827	53815	1.0132
Urban 4 & 5	6	28603	28856	28847	29016	29560	28798	0.9989
Urban 6 & 7	42	8709	8701	8632	8587	8610	8730	0.9988
Rural	16	4207	4176	4129	4094	4184	4501	1.0148
Florida	67	99336	101896	105085	107946	110473	112816	1.0276
Metro	34	183731	188518	194625	200201	205122	208665	1.0307
Urban 4 & 5	3	38338	39471	40748	41755	42205	44622	1.0319
Urban 6 & 7	20	12209	12385	12432	12377	12408	13571	1.0190
Rural	10	4946	5127	5252	5271	5274	5875	1.0328
Georgia	159	22157	22882	23596	24287	24853	25686	1.0246
Metro	42	59315	61638	63685	66055	67753	70223	1.0376
Urban 4 & 5	7	30240	30939	31695	32021	32306	32328	1.0173
Urban 6 & 7	66	9892	10026	10266	10356	10554	10836	1.0154
Rural	44	3799	3890	4035	4084	4167	4392	1.0273
Kentucky	120	14643	14811	15082	15273	15452	15590	1.0127
Metro	22	42399	42969	44062	44726	45398	45176	1.0201
Urban 4 & 5	4	33061	33710	34138	34234	34659	35969	1.0154
Urban 6 & 7	51	10043	10110	10210	10353	10412	10614	1.0101
Rural	43	4184	4221	4260	4276	4323	4459	1.0117

Table A.2 (continues) Average Number of People Employed and Its Average Annual Rate of Change, by State and RUC, 1995 - 2000

State by RUC	No of Counties	Average of the Total Number of People Employed						EMPGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	28443	28992	29533	29983	30105	30115	1.0095
Metro	24	59122	60564	61869	62958	63266	63004	1.0164
Urban 4 & 5	5	24236	24730	25294	25701	25309	25411	1.0078
Urban 6 & 7	27	9224	9171	9203	9202	9263	9413	1.0024
Rural	8	3902	3835	3788	3871	3965	4259	1.0134
Mississippi	82	14333	14476	14645	14775	14923	15170	1.0119
Metro	7	57102	58660	59942	61753	62942	62523	1.0271
Urban 4 & 5	8	28221	28172	28243	28191	28234	27694	0.9947
Urban 6 & 7	43	10500	10523	10620	10615	10693	11154	1.0110
Rural	24	4097	4106	4111	4054	4061	4381	1.0150
North Carolina	100	35827	37041	38096	38448	39212	39594	1.0157
Metro	35	70679	73530	75738	76784	78648	79256	1.0207
Urban 4 & 5	8	38831	39358	40263	40060	40373	40318	1.0059
Urban 6 & 7	35	18910	19298	19801	19784	19921	20411	1.0136
Rural	22	6198	6376	6529	6566	6743	6751	1.0147
South Carolina	46	38144	38818	39555	40197	40802	41215	1.0118
Metro	16	79040	80600	82352	84255	85880	85927	1.0169
Urban 4 & 5	4	34788	35718	36496	36777	36873	37174	1.0116
Urban 6 & 7	23	14530	14614	14706	14615	14672	15357	1.0069
Rural	3	5554	5683	5891	5922	5954	6387	1.0216
Tennessee	95	27095	27484	27790	28265	28654	28944	1.0150
Metro	26	68186	69380	70535	71998	73182	73554	1.0205
Urban 4 & 5	7	28722	28853	28842	29111	29057	29574	1.0044
Urban 6 & 7	40	12363	12491	12505	12635	12779	12952	1.0131
Rural	22	4799	4794	4729	4729	4766	5100	1.0154
West Virginia	55	13162	13377	13572	13721	13862	13910	1.0164
Metro	12	28105	28536	29029	29522	29968	29414	1.0135
Urban 4 & 5	4	29486	30180	30664	30979	31382	31077	1.0108
Urban 6 & 7	18	10095	10178	10252	10264	10264	10536	1.0114
Rural	21	4142	4255	4329	4367	4405	4673	1.0233

Table A.3 Average Number of Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Establishments						ESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	1513	1549	1596	1606	1620	1629	1.0152
Metro	250	4202	4306	4444	4477	4524	4561	1.0308
Urban 4 & 5	62	1659	1693	1736	1747	1755	1753	1.0174
Urban 6 & 7	397	538	551	563	564	565	564	1.0086
Rural	221	180	185	189	190	191	190	1.0087
Alabama	67	1433	1465	1496	1497	1500	1489	1.0031
Metro	21	3282	3352	3428	3433	3447	3434	1.0173
Urban 4 & 5	6	1256	1301	1330	1336	1341	1312	1.0149
Urban 6 & 7	32	555	567	578	576	572	565	0.9954
Rural	8	225	223	223	218	218	215	0.9876
Arkansas	75	803	817	831	831	836	842	1.0137
Metro	11	2684	2730	2779	2787	2830	2866	1.0300
Urban 4 & 5	6	1579	1625	1651	1665	1654	1656	1.0208
Urban 6 & 7	42	438	444	450	447	446	448	1.0124
Rural	16	174	179	181	181	181	179	1.0032
Florida	67	5943	6079	6231	6278	6329	6393	1.0149
Metro	34	11066	11313	11600	11685	11783	11912	1.0270
Urban 4 & 5	3	2951	3050	3118	3169	3179	3187	1.0297
Urban 6 & 7	20	553	570	581	581	584	581	1.0033
Rural	10	206	213	214	218	218	217	0.9924
Georgia	159	1126	1159	1203	1221	1244	1260	1.0253
Metro	42	3110	3201	3337	3397	3470	3524	1.0522
Urban 4 & 5	7	1674	1705	1740	1749	1751	1767	1.0226
Urban 6 & 7	66	456	470	480	482	487	489	1.0082
Rural	44	149	159	165	169	173	176	1.0258
Kentucky	120	709	724	742	746	749	749	1.0199
Metro	22	2107	2159	2217	2226	2238	2251	1.0340
Urban 4 & 5	4	1813	1858	1914	1933	1940	1936	1.0284
Urban 6 & 7	51	486	493	502	507	508	503	1.0162
Rural	43	155	158	162	163	162	161	1.0163

Table A.3 (continues) Average Number of Establishments and Its Average Annual Rate of Change, by RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Establishments						ESTGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	1499	1533	1573	1571	1577	1575	1.0050
Metro	24	3219	3289	3375	3374	3391	3392	1.0195
Urban 4 & 5	5	1225	1263	1311	1314	1314	1313	1.0225
Urban 6 & 7	27	420	429	437	433	431	427	0.9960
Rural	8	153	160	165	163	163	162	0.9815
Mississippi	82	696	708	723	728	729	728	1.0084
Metro	7	2702	2765	2835	2876	2907	2943	1.0392
Urban 4 & 5	8	1603	1597	1628	1633	1643	1631	1.0057
Urban 6 & 7	43	496	509	520	522	519	515	1.0107
Rural	24	166	169	169	170	166	163	0.9963
North Carolina	100	1820	1879	1975	1987	2017	2039	1.0184
Metro	35	3643	3768	3986	4008	4075	4130	1.0290
Urban 4 & 5	8	1835	1869	1939	1955	1985	1988	1.0144
Urban 6 & 7	35	963	993	1028	1036	1047	1053	1.0170
Rural	22	275	288	294	295	296	297	1.0052
South Carolina	46	1912	1963	2041	2064	2096	2111	1.0232
Metro	16	4068	4175	4350	4411	4483	4510	1.0338
Urban 4 & 5	4	2019	2085	2157	2179	2225	2274	1.0330
Urban 6 & 7	23	616	630	651	651	655	656	1.0153
Rural	3	210	226	238	234	242	256	1.0147
Tennessee	95	1314	1343	1378	1380	1380	1377	1.0093
Metro	26	3530	3612	3707	3717	3720	3715	1.0293
Urban 4 & 5	7	1312	1328	1363	1362	1364	1354	1.0098
Urban 6 & 7	40	508	520	533	531	529	528	1.0058
Rural	22	160	163	167	167	167	165	0.9916
West Virginia	55	738	746	756	758	753	746	1.0118
Metro	12	1528	1548	1573	1580	1585	1568	1.0068
Urban 4 & 5	4	1781	1803	1830	1825	1813	1784	1.0079
Urban 6 & 7	18	595	601	603	603	591	590	1.0034
Rural	21	209	211	216	218	215	211	1.0227

Table A.4 Average Number of Small Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Small Sized Establishments						SESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	1313	1345	1385	1390	1399	1402	1.0107
Metro	250	3625	3713	3830	3848	3879	3900	1.0209
Urban 4 & 5	62	1444	1473	1509	1514	1519	1510	1.0079
Urban 6 & 7	397	477	489	500	500	500	497	1.0063
Rural	221	163	168	172	173	173	172	1.0080
Alabama	67	1235	1262	1288	1286	1285	1274	1.0053
Metro	21	2804	2860	2920	2919	2918	2904	1.0141
Urban 4 & 5	6	1089	1132	1158	1162	1162	1128	1.0067
Urban 6 & 7	32	491	503	513	510	508	500	1.0028
Rural	8	205	202	203	197	197	195	0.9913
Arkansas	75	703	715	727	724	728	730	1.0045
Metro	11	2297	2331	2381	2375	2407	2429	1.0134
Urban 4 & 5	6	1390	1431	1452	1455	1443	1440	1.0061
Urban 6 & 7	42	394	399	404	400	400	400	1.0018
Rural	16	161	165	168	166	166	164	1.0049
Florida	67	5255	5377	5512	5543	5582	5629	1.0144
Metro	34	9770	9991	10247	10303	10376	10470	1.0192
Urban 4 & 5	3	2678	2773	2826	2862	2883	2883	1.0158
Urban 6 & 7	20	500	515	524	524	528	525	1.0105
Rural	10	187	195	197	200	200	200	1.0051
Georgia	159	965	994	1031	1045	1062	1072	1.0203
Metro	42	2644	2719	2834	2881	2937	2973	1.0383
Urban 4 & 5	7	1431	1453	1487	1490	1483	1489	1.0106
Urban 6 & 7	66	401	414	422	424	428	426	1.0090
Rural	44	135	144	150	153	156	160	1.0216
Kentucky	120	607	621	635	638	638	634	1.0081
Metro	22	1771	1816	1861	1862	1864	1865	1.0180
Urban 4 & 5	4	1547	1584	1630	1644	1642	1618	1.0093
Urban 6 & 7	51	426	433	441	445	445	439	1.0065
Rural	43	140	143	146	147	146	144	1.0047

Table A.4 (continues) Average Number of Small Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Small Sized Establishments						SESTGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	1287	1315	1350	1340	1346	1342	1.0091
Metro	24	2742	2801	2872	2854	2870	2867	1.0144
Urban 4 & 5	5	1061	1088	1133	1125	1135	1129	1.0114
Urban 6 & 7	27	375	384	393	387	386	381	1.0024
Rural	8	136	145	149	147	146	147	1.0145
Mississippi	82	608	618	630	633	633	630	1.0041
Metro	7	2321	2366	2422	2446	2467	2486	1.0253
Urban 4 & 5	8	1384	1380	1404	1406	1412	1395	1.0028
Urban 6 & 7	43	441	451	461	462	459	455	1.0059
Rural	24	150	152	152	154	149	147	0.9951
North Carolina	100	1567	1619	1702	1707	1727	1740	1.0177
Metro	35	3100	3206	3395	3401	3446	3481	1.0233
Urban 4 & 5	8	1587	1615	1674	1684	1710	1709	1.0117
Urban 6 & 7	35	856	884	915	920	928	931	1.0151
Rural	22	251	265	270	270	270	271	1.0151
South Carolina	46	1663	1704	1768	1783	1806	1810	1.0120
Metro	16	3509	3596	3737	3780	3828	3834	1.0191
Urban 4 & 5	4	1791	1848	1906	1922	1959	1992	1.0160
Urban 6 & 7	23	549	559	576	576	580	577	1.0036
Rural	3	188	204	216	209	216	231	1.0340
Tennessee	95	1119	1144	1172	1168	1164	1156	1.0096
Metro	26	2974	3041	3114	3110	3097	3077	1.0170
Urban 4 & 5	7	1129	1143	1178	1167	1166	1152	1.0040
Urban 6 & 7	40	448	460	471	468	465	463	1.0074
Rural	22	142	145	150	149	150	147	1.0067
West Virginia	55	649	657	662	664	659	650	0.9994
Metro	12	1327	1345	1360	1362	1366	1346	1.0028
Urban 4 & 5	4	1564	1583	1591	1589	1571	1539	0.9966
Urban 6 & 7	18	530	536	536	538	528	525	0.9979
Rural	21	191	192	195	197	195	191	0.9992

Table A.5 Average Number of Medium Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Medium Sized Establishments						MESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	164	168	174	178	181	186	1.0250
Metro	250	476	488	506	517	529	542	1.0380
Urban 4 & 5	62	177	181	188	193	196	202	1.0241
Urban 6 & 7	397	49	50	52	52	53	54	1.0174
Rural	221	14	14	14	15	15	15	1.0241
Alabama	67	162	166	172	174	177	177	1.0088
Metro	21	394	405	423	427	439	437	1.0266
Urban 4 & 5	6	135	135	140	142	146	150	1.0214
Urban 6 & 7	32	51	51	52	53	52	52	0.9972
Rural	8	16	17	16	17	16	16	0.9988
Arkansas	75	82	84	85	88	89	92	1.0203
Metro	11	319	328	329	338	349	361	1.0326
Urban 4 & 5	6	156	161	163	173	175	177	1.0241
Urban 6 & 7	42	37	37	38	39	38	39	1.0119
Rural	16	11	11	12	13	13	13	1.0324
Florida	67	574	582	593	603	611	625	1.0159
Metro	34	1078	1093	1112	1132	1148	1176	1.0246
Urban 4 & 5	3	241	247	256	265	254	262	1.0124
Urban 6 & 7	20	45	47	48	49	48	47	1.0116
Rural	10	16	15	15	16	16	16	0.9957
Georgia	159	132	135	140	144	147	153	1.0378
Metro	42	383	393	411	422	431	445	1.0576
Urban 4 & 5	7	198	207	208	212	219	226	1.0255
Urban 6 & 7	66	44	45	46	47	48	51	1.0247
Rural	44	12	12	13	13	14	14	1.0406
Kentucky	120	84	84	87	89	91	94	1.0236
Metro	22	276	282	292	297	306	313	1.0405
Urban 4 & 5	4	223	226	234	241	250	265	1.0389
Urban 6 & 7	51	50	49	50	51	52	53	1.0162
Rural	43	12	12	13	13	14	14	1.0224

Table A.5 (continues) Average Number of Medium Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Medium Sized Establishments						MESTGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	179	183	188	195	194	197	1.0156
Metro	24	400	409	423	439	438	444	1.0295
Urban 4 & 5	5	140	150	153	161	153	157	1.0202
Urban 6 & 7	27	38	38	38	39	39	39	1.0083
Rural	8	14	13	14	15	14	13	0.9957
Mississippi	82	71	73	76	78	79	82	1.0220
Metro	7	315	329	342	358	364	384	1.0586
Urban 4 & 5	8	179	177	185	188	191	196	1.0188
Urban 6 & 7	43	44	46	48	48	48	49	1.0216
Rural	24	13	13	14	13	13	13	1.0130
North Carolina	100	205	212	223	229	237	245	1.0342
Metro	35	441	458	483	496	514	531	1.0423
Urban 4 & 5	8	201	206	214	222	226	229	1.0246
Urban 6 & 7	35	87	88	92	95	98	101	1.0312
Rural	22	20	20	20	21	23	23	1.0294
South Carolina	46	204	212	226	231	238	248	1.0326
Metro	16	461	478	510	522	542	560	1.0441
Urban 4 & 5	4	188	194	211	210	217	233	1.0395
Urban 6 & 7	23	52	55	59	59	59	63	1.0289
Rural	3	20	20	20	22	22	23	0.9902
Tennessee	95	159	162	168	172	175	180	1.0264
Metro	26	458	469	486	496	509	522	1.0374
Urban 4 & 5	7	144	148	148	157	158	161	1.0164
Urban 6 & 7	40	47	47	49	50	50	52	1.0204
Rural	22	13	13	13	13	14	15	1.0274
West Virginia	55	74	75	80	80	80	82	1.0181
Metro	12	167	169	180	184	185	187	1.0128
Urban 4 & 5	4	183	186	209	204	210	213	1.0326
Urban 6 & 7	18	56	56	58	56	54	57	1.0053
Rural	21	17	17	19	18	17	18	1.0293

Table A.6 Average Number of Large Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Medium Sized Establishments						LESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	35	36	37	39	40	41	1.0098
Metro	250	100	105	108	112	116	119	1.0335
Urban 4 & 5	62	38	39	39	40	41	42	1.0203
Urban 6 & 7	397	12	12	12	12	12	12	1.0020
Rural	221	3	3	3	3	3	3	0.9940
Alabama	67	36	37	36	37	38	38	0.9952
Metro	21	84	87	85	88	90	92	1.0114
Urban 4 & 5	6	32	35	33	33	33	34	1.0165
Urban 6 & 7	32	14	13	13	13	13	13	0.9862
Rural	8	5	4	4	4	5	4	0.9725
Arkansas	75	18	18	18	19	19	20	1.0163
Metro	11	68	70	69	74	74	76	1.0440
Urban 4 & 5	6	32	34	36	37	37	39	1.0323
Urban 6 & 7	42	8	9	8	8	9	9	1.0236
Rural	16	2	2	2	2	2	2	0.9723
Florida	67	115	120	127	132	136	140	1.0144
Metro	34	218	229	240	250	258	266	1.0371
Urban 4 & 5	3	32	30	37	42	42	43	1.0608
Urban 6 & 7	20	8	8	8	9	9	9	0.9878
Rural	10	2	3	3	2	2	2	0.9763
Georgia	159	29	31	32	32	35	36	1.0179
Metro	42	82	89	92	94	102	105	1.0608
Urban 4 & 5	7	45	44	46	47	49	51	1.0317
Urban 6 & 7	66	11	12	11	11	12	12	0.9909
Rural	44	2	3	2	3	3	3	1.0153
Kentucky	120	18	18	19	20	20	21	1.0280
Metro	22	60	62	65	68	69	73	1.0436
Urban 4 & 5	4	44	49	51	49	49	53	1.0371
Urban 6 & 7	51	10	10	11	11	11	12	1.0259
Rural	43	3	3	3	3	3	3	1.0217

Table A.6 (continues) Average Number of Large Sized Establishments and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average of the Total Number of Medium Sized Establishments						LESTGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	34	35	35	36	36	36	0.9904
Metro	24	76	79	80	81	82	82	1.0145
Urban 4 & 5	5	24	25	25	28	26	27	1.0361
Urban 6 & 7	27	7	7	7	7	7	7	0.9772
Rural	8	3	3	3	2	2	2	0.9343
Mississippi	82	17	17	17	17	17	17	0.9993
Metro	7	67	70	71	72	76	73	1.0337
Urban 4 & 5	8	40	41	39	40	40	40	0.9953
Urban 6 & 7	43	11	11	12	12	11	11	1.0047
Rural	24	4	4	4	4	4	3	0.9809
North Carolina	100	48	48	50	51	52	53	1.0033
Metro	35	102	104	107	111	116	118	1.0213
Urban 4 & 5	8	48	48	51	48	50	50	1.0069
Urban 6 & 7	35	20	20	21	21	20	21	1.0048
Rural	22	4	4	4	4	4	4	0.9710
South Carolina	46	45	47	47	51	52	53	1.0250
Metro	16	98	101	103	110	113	116	1.0382
Urban 4 & 5	4	39	43	41	47	50	49	1.0434
Urban 6 & 7	23	16	16	16	16	16	16	1.0134
Rural	3	2	2	2	3	3	2	1.0197
Tennessee	95	36	37	39	40	41	42	0.9918
Metro	26	98	102	107	111	114	117	1.0335
Urban 4 & 5	7	39	37	37	38	40	41	1.0090
Urban 6 & 7	40	14	13	13	13	14	14	0.9897
Rural	22	5	4	4	4	4	4	0.9408
West Virginia	55	14	14	13	14	14	14	1.0180
Metro	12	34	34	34	34	35	35	1.0048
Urban 4 & 5	4	33	33	31	33	32	33	0.9945
Urban 6 & 7	18	9	9	9	9	9	9	1.0070
Rural	21	2	2	2	2	2	3	1.0395

Table A.7 Average Population Density per Square Mile and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average Population Density per Square Mile						DENGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	117	118	119	121	122	124	1.0099
Metro	250	293	297	301	305	309	313	1.0162
Urban 4 & 5	62	130	132	133	134	134	135	1.0054
Urban 6 & 7	397	52	53	53	54	54	55	1.0070
Rural	221	29	29	29	30	30	30	1.0094
Alabama	67	78	78	79	80	80	80	1.0054
Metro	21	160	161	162	164	165	165	1.0102
Urban 4 & 5	6	92	93	94	95	95	96	1.0041
Urban 6 & 7	32	36	37	37	37	37	37	1.0036
Rural	8	18	18	18	18	18	18	1.0010
Arkansas	75	45	46	46	47	47	47	1.0049
Metro	11	135	137	139	140	141	143	1.0141
Urban 4 & 5	6	71	72	73	74	74	75	1.0075
Urban 6 & 7	42	29	29	29	30	30	30	1.0011
Rural	16	16	16	16	16	17	17	1.0078
Florida	67	245	249	253	256	260	263	1.0165
Metro	34	439	445	452	459	465	471	1.0189
Urban 4 & 5	3	154	156	157	159	161	163	1.0087
Urban 6 & 7	20	40	41	42	42	43	43	1.0123
Rural	10	22	23	24	24	24	25	1.0190
Georgia	159	139	142	145	148	151	154	1.0170
Metro	42	385	394	402	411	420	429	1.0281
Urban 4 & 5	7	165	166	168	169	170	171	1.0068
Urban 6 & 7	66	55	56	57	57	58	59	1.0109
Rural	44	27	28	29	29	30	31	1.0171
Kentucky	120	100	101	102	103	103	104	1.0087
Metro	22	290	292	294	297	299	301	1.0136
Urban 4 & 5	4	192	193	193	194	195	196	1.0046
Urban 6 & 7	51	67	67	68	68	69	69	1.0071
Rural	43	35	35	36	36	36	36	1.0086

Table A.7 (continues) Average Population Density per Square Mile and Its Average Annual Rate of Change, by State and RUC, 1995 -2000

State by RUC	No of Counties	Average Population Density per Square Mile						DENGRO
		1995	1996	1997	1998	1999	2000	
Louisiana	64	142	143	143	143	143	143	1.0032
Metro	24	316	317	317	317	317	317	1.0064
Urban 4 & 5	5	89	89	89	89	90	90	0.9990
Urban 6 & 7	27	34	34	34	34	34	34	1.0010
Rural	8	22	22	22	22	22	22	1.0033
Mississippi	82	55	55	56	56	57	57	1.0058
Metro	7	173	176	178	181	184	187	1.0209
Urban 4 & 5	8	104	105	105	106	106	106	1.0004
Urban 6 & 7	43	46	46	46	47	47	47	1.0066
Rural	24	20	20	20	21	21	21	1.0018
North Carolina	100	147	149	152	154	156	158	1.0131
Metro	35	275	280	285	290	294	298	1.0168
Urban 4 & 5	8	145	147	149	150	152	153	1.0087
Urban 6 & 7	35	88	89	90	91	92	93	1.0115
Rural	22	39	39	40	40	41	41	1.0115
South Carolina	46	110	111	113	114	115	117	1.0085
Metro	16	203	205	208	211	214	216	1.0130
Urban 4 & 5	4	125	127	129	130	131	132	1.0089
Urban 6 & 7	23	54	55	55	55	56	56	1.0047
Rural	3	27	27	28	29	29	29	1.0141
Tennessee	95	111	113	114	116	117	118	1.0136
Metro	26	250	253	257	260	262	264	1.0182
Urban 4 & 5	7	155	157	160	162	163	164	1.0111
Urban 6 & 7	40	55	56	57	58	58	59	1.0129
Rural	22	35	35	36	36	36	37	1.0101
West Virginia	55	95	95	95	95	95	94	0.9996
Metro	12	234	234	234	233	233	232	0.9997
Urban 4 & 5	4	174	174	174	174	173	172	0.9976
Urban 6 & 7	18	62	62	61	61	61	61	0.9967
Rural	21	29	29	29	30	30	30	1.0023

Table A.8 Average Number of People In- and Out-Migrated from 1995 to 2000 and Migration Rates, by State and RUC

State by RUC	No of Counties	Average Inflow		Average Outflow	
		Number	Rate	Number	Rate
Southeast	930	12790	38.0782	11063	161.4454
Metro	250	35048	45.2340	30225	179.5874
Urban 4 & 5	62	13525	37.5961	12413	179.0176
Urban 6 & 7	397	4598	33.6266	4008	152.2605
Rural	221	2122	38.1156	1681	152.4927
Alabama	67	10329	31.1398	9944	151.5464
Metro	21	22587	36.8948	21637	159.0570
Urban 4 & 5	6	13061	36.5152	11618	174.3520
Urban 6 & 7	32	3955	28.2715	3981	146.5322
Rural	8	1597	23.4743	1846	134.7838
Arkansas	75	6839	38.3339	6278	185.9025
Metro	11	23184	45.9462	20061	184.3050
Urban 4 & 5	6	12206	37.8779	10699	173.9760
Urban 6 & 7	42	3512	34.8494	3705	190.3402
Rural	16	2324	42.4184	1898	179.8242
Florida	67	47354	52.1379	38294	182.0612
Metro	34	85280	52.0574	69873	185.1987
Urban 4 & 5	3	26555	54.4795	19170	206.7317
Urban 6 & 7	20	7754	49.4423	5468	178.9179
Rural	10	3847	57.1003	2315	170.2791
Georgia	159	12643	45.8833	10500	178.0323
Metro	42	36108	58.1224	30219	217.8183
Urban 4 & 5	7	15266	46.0877	14364	213.8655
Urban 6 & 7	66	4410	37.2401	3571	156.9350
Rural	44	2178	47.1330	1458	166.0002
Kentucky	120	5713	34.7456	5429	153.9879
Metro	22	16284	45.0586	15740	187.5627
Urban 4 & 5	4	15846	42.7135	15595	206.5075
Urban 6 & 7	51	3748	31.8675	3487	146.9937
Rural	43	1693	32.1416	1510	140.2199

Table A.8 (continues) Average Number of People In- and Out-Migrated from 1995 to 2000 and Migration Rates, by State and RUC

State by RUC	No of Counties	Average Inflow		Average Outflow	
		Number	Rate	Number	Rate
Louisiana	64	10025	30.3977	11209	155.2792
Metro	24	19828	29.1196	22875	155.8176
Urban 4 & 5	5	10858	36.5125	12095	209.4103
Urban 6 & 7	27	3476	28.2923	3488	144.6223
Rural	8	2201	37.5162	1715	155.7991
Mississippi	82	5805	31.8303	5476	153.2823
Metro	7	26641	47.7802	22577	174.4639
Urban 4 & 5	8	9357	28.9766	11029	174.8035
Urban 6 & 7	43	4133	30.9120	3829	148.9370
Rural	24	1539	29.7748	1589	147.7159
North Carolina	100	16580	40.5691	13201	158.1967
Metro	35	34433	46.2953	27567	176.2579
Urban 4 & 5	8	14116	32.2083	12246	146.8960
Urban 6 & 7	35	7898	37.4447	5995	145.9810
Rural	22	2886	39.4701	2157	153.0062
South Carolina	46	16423	35.1521	13549	150.6671
Metro	16	35209	42.0219	28471	167.0542
Urban 4 & 5	4	17332	39.4976	14352	167.7914
Urban 6 & 7	23	4918	27.9055	4502	134.1025
Rural	3	3226	48.2761	2254	167.4320
Tennessee	95	10860	38.7524	9320	146.0792
Metro	26	27511	43.5014	24863	167.4640
Urban 4 & 5	7	11023	37.8243	9171	160.0237
Urban 6 & 7	40	4796	35.8113	3523	133.5613
Rural	22	2158	38.7827	1540	139.1293
West Virginia	55	4703	28.7682	4898	144.1684
Metro	12	9360	30.7395	9678	150.0806
Urban 4 & 5	4	12121	33.2224	11746	163.4644
Urban 6 & 7	18	3390	23.9722	4001	138.1173
Rural	21	1753	30.9042	1631	142.3013

Table A.9 Average for Human Development Index or County Well-Being Index, by State and RUC, 2000

State by RUC	No of Counties	Human Development Index		
		EDUC_00	ECON_00	HOUS_00
Southeast	930	0.3787	0.5418	0.1657
Metro	250	0.4969	0.7085	0.3062
Urban 4 & 5	62	0.4414	0.5681	0.2232
Urban 6 & 7	397	0.3331	0.4825	0.1137
Rural	221	0.3091	0.4522	0.0840
Alabama	67	0.3109	0.5249	0.1458
Metro	21	0.4255	0.6893	0.2804
Urban 4 & 5	6	0.3511	0.5389	0.1554
Urban 6 & 7	32	0.2377	0.4551	0.0819
Rural	8	0.2727	0.3617	0.0406
Arkansas	75	0.4371	0.5472	0.2000
Metro	11	0.6179	0.7551	0.4473
Urban 4 & 5	6	0.5269	0.5801	0.3119
Urban 6 & 7	42	0.4068	0.4948	0.1486
Rural	16	0.3586	0.5295	0.1229
Florida	67	0.4304	0.6003	0.1586
Metro	34	0.5193	0.7329	0.2580
Urban 4 & 5	3	0.4331	0.6844	0.2042
Urban 6 & 7	20	0.3380	0.4390	0.0464
Rural	10	0.3120	0.4470	0.0314
Georgia	159	0.3485	0.5009	0.1384
Metro	42	0.4781	0.6759	0.2684
Urban 4 & 5	7	0.4121	0.5371	0.1693
Urban 6 & 7	66	0.3015	0.4328	0.0915
Rural	44	0.2853	0.4301	0.0797
Kentucky	120	0.4060	0.5690	0.1217
Metro	22	0.5796	0.7363	0.2414
Urban 4 & 5	4	0.6170	0.7067	0.2160
Urban 6 & 7	51	0.3888	0.5622	0.1067
Rural	43	0.3181	0.4787	0.0696

Table A.9 (continues) Average for Human Development Index or County Well-Being Index, by State and RUC, 2000

State by RUC	No of Counties	Human Development Index		
		EDUC_00	ECON_00	HOUS_00
Louisiana	64	0.3902	0.5264	0.2197
Metro	24	0.4896	0.6789	0.3766
Urban 4 & 5	5	0.4418	0.5117	0.2311
Urban 6 & 7	27	0.3137	0.4191	0.1121
Rural	8	0.3181	0.4401	0.1048
Mississippi	82	0.3300	0.5155	0.1979
Metro	7	0.5426	0.8054	0.5975
Urban 4 & 5	8	0.4352	0.5660	0.3024
Urban 6 & 7	43	0.3084	0.5213	0.1732
Rural	24	0.2716	0.4038	0.0909
North Carolina	100	0.3862	0.5374	0.1812
Metro	35	0.4505	0.6902	0.2917
Urban 4 & 5	8	0.3763	0.4368	0.1619
Urban 6 & 7	35	0.3725	0.4795	0.1348
Rural	22	0.3096	0.4231	0.0865
South Carolina	46	0.3850	0.6332	0.2158
Metro	16	0.4824	0.7980	0.4024
Urban 4 & 5	4	0.4749	0.6614	0.2719
Urban 6 & 7	23	0.3081	0.5200	0.0961
Rural	3	0.3361	0.5846	0.0628
Tennessee	95	0.3463	0.5197	0.1052
Metro	26	0.4734	0.6470	0.2202
Urban 4 & 5	7	0.3850	0.5845	0.1183
Urban 6 & 7	40	0.3074	0.4803	0.0650
Rural	22	0.2545	0.4204	0.0383
West Virginia	55	0.4419	0.5691	0.2496
Metro	12	0.5550	0.7639	0.3985
Urban 4 & 5	4	0.5376	0.6380	0.3978
Urban 6 & 7	18	0.3848	0.4731	0.2141
Rural	21	0.4080	0.5270	0.1668

Table A.10 Average for All Exogenous Variables of the Model, by State and RUC

State by RUC	No of Counties	Demographic Characteristics			Socioeconomic Level			Urban Transition
		LNNATINC	MEDAGE	RACE	ECON_90	EDUC_90	HOUS_90	LNGRAV
Southeast	930	0.2627	35	0.4331	0.5510	0.3819	0.1592	12.1649
Metro	250	0.4635	34	0.3207	0.7143	0.4762	0.3037	14.0302
Urban 4 & 5	62	0.3584	34	0.4602	0.6100	0.4430	0.2265	12.8234
Urban 6 & 7	397	0.2077	35	0.4630	0.4968	0.3504	0.1064	11.6953
Rural	221	0.1074	35	0.4991	0.4469	0.3149	0.0718	10.7138
Alabama	67	0.2652	34	0.6991	0.5438	0.3344	0.1340	12.7242
Metro	21	0.4083	34	0.3093	0.7120	0.4401	0.2715	14.1966
Urban 4 & 5	6	0.3213	34	0.5381	0.5518	0.3876	0.1544	13.1433
Urban 6 & 7	32	0.1716	35	0.7834	0.4785	0.2613	0.0656	12.0078
Rural	8	0.2219	33	1.5062	0.3574	0.3096	0.0312	11.4099
Arkansas	75	0.1209	36	0.2907	0.5668	0.3825	0.1874	11.3200
Metro	11	0.5009	33	0.2865	0.7582	0.5384	0.4206	13.1318
Urban 4 & 5	6	0.2604	34	0.2153	0.6314	0.4592	0.3016	12.5277
Urban 6 & 7	42	0.0770	36	0.3563	0.5225	0.3635	0.1434	11.0824
Rural	16	-0.0772	39	0.1495	0.5275	0.2962	0.0998	10.2453
Florida	67	0.1390	37	0.3536	0.5736	0.4237	0.1704	13.5212
Metro	34	0.1629	38	0.3593	0.6993	0.4981	0.2764	15.2268
Urban 4 & 5	3	-0.3182	45	0.1670	0.6580	0.3866	0.2282	13.2693
Urban 6 & 7	20	0.1503	36	0.3863	0.4138	0.3569	0.0504	11.9004
Rural	10	0.1724	35	0.3245	0.4403	0.3154	0.0328	11.0394
Georgia	159	0.4309	33	0.5893	0.4927	0.3851	0.1265	12.0967
Metro	42	0.7490	32	0.4180	0.6425	0.4768	0.2580	14.0788
Urban 4 & 5	7	0.6700	32	0.5481	0.5678	0.4319	0.1746	13.2288
Urban 6 & 7	66	0.3299	33	0.5961	0.4328	0.3634	0.0821	11.6044
Rural	44	0.2409	35	0.7493	0.4274	0.3229	0.0600	10.7629
Kentucky	120	0.2272	35	0.0523	0.5531	0.3980	0.1195	11.7397
Metro	22	0.5075	34	0.0777	0.7475	0.5393	0.2491	13.3456
Urban 4 & 5	4	0.4667	33	0.1364	0.7301	0.5790	0.2329	13.0973
Urban 6 & 7	51	0.1883	35	0.0542	0.5440	0.3857	0.1045	11.7352
Rural	43	0.1077	35	0.0292	0.4479	0.3236	0.0604	10.7973

Table A.10 (continues) Average for All Exogenous Variables of the Model, by State and RUC

State by RUC	No of Counties	Demographic Characteristics			Socioeconomic Level			Urban Transition
		LNNATINC	MEDAGE	RACE	ECON_90	EDUC_90	HOUS_90	LNGRAV
Louisiana	4.6795	0.4071	32	0.6084	0.6170	0.3934	0.2042	12.5216
Metro	6.7916	0.6059	32	0.5351	0.7424	0.4815	0.3731	14.2564
Urban 4 & 5	7.8588	0.6677	29	0.5676	0.6491	0.4323	0.2251	12.6359
Urban 6 & 7	3.2324	0.2584	33	0.6646	0.5248	0.3381	0.0873	11.4836
Rural	1.2399	0.1498	33	0.6641	0.5322	0.2914	0.0790	10.7492
Mississippi	4.4053	0.3544	32	0.9607	0.5843	0.4035	0.1952	11.8875
Metro	6.5686	0.5986	33	0.4625	0.8360	0.5957	0.5678	14.3845
Urban 4 & 5	5.7980	0.4532	31	0.8178	0.6607	0.5251	0.3201	12.6031
Urban 6 & 7	4.1691	0.3293	33	0.7676	0.5948	0.3781	0.1677	11.8501
Rural	3.7332	0.2950	32	1.4995	0.4668	0.3525	0.0943	10.9878
North Carolina	2.9837	0.2546	36	0.4371	0.5917	0.3366	0.1824	12.5999
Metro	5.3997	0.4803	34	0.3083	0.7348	0.3810	0.2952	14.2730
Urban 4 & 5	4.6416	0.3622	35	0.7039	0.5526	0.3475	0.1782	13.0574
Urban 6 & 7	2.7610	0.2255	36	0.4489	0.5566	0.3333	0.1376	12.0628
Rural	-1.1084	-0.0974	38	0.5263	0.4341	0.2674	0.0759	10.6265
South Carolina	3.9751	0.3480	34	0.7793	0.5725	0.3987	0.2158	12.3439
Metro	5.1466	0.4748	33	0.4335	0.7778	0.4753	0.4171	13.2387
Urban 4 & 5	4.4819	0.3879	33	0.7798	0.6083	0.4772	0.2676	12.7025
Urban 6 & 7	3.3337	0.2726	34	0.9477	0.4408	0.3477	0.0904	11.8354
Rural	1.9696	0.1974	34	1.3317	0.4396	0.2767	0.0346	10.9925
Tennessee	1.9659	0.1799	36	0.1221	0.5001	0.3316	0.0983	12.5462
Metro	4.2122	0.3893	35	0.1826	0.6417	0.4570	0.2110	14.4074
Urban 4 & 5	2.5879	0.2345	36	0.1088	0.5549	0.3716	0.1161	12.9911
Urban 6 & 7	1.5214	0.1271	36	0.1201	0.4430	0.2944	0.0579	12.0564
Rural	-0.0787	0.0111	37	0.0583	0.4192	0.2384	0.0328	11.0957
West Virginia	-0.4110	-0.0239	37	0.0299	0.5437	0.4535	0.2284	10.5077
Metro	0.2921	0.0303	37	0.0407	0.7966	0.5426	0.3721	11.1276
Urban 4 & 5	-0.1457	0.0179	36	0.0595	0.6452	0.5590	0.3682	11.5031
Urban 6 & 7	-0.8237	-0.0572	37	0.0374	0.4618	0.4363	0.1981	10.8138
Rural	-0.5095	-0.0344	37	0.0117	0.4501	0.3973	0.1455	9.7015

Table A.11 Coastal Differences in Average Real per Capita Personal Income and Its Average Annual Rate of Change, by State, 1995 - 2000

State	No. of counties	Average Per Capita Personal Income in 2000 dollar value						PINCGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	19409	19844	20380	21016	21311	21632	1.0213
Coastal	206	20045	20544	21124	21830	21998	22414	1.0218
Non-Coastal	724	19228	19645	20168	20784	21116	21409	1.0212
Coastal States								
Alabama	67	19424	19518	19962	20646	20989	20929	1.0149
Coastal	8	19249	19481	19943	20562	20727	20755	1.0148
Non-Coastal	59	19448	19523	19965	20658	21025	20952	1.0149
Florida	67	21843	22311	22927	24035	24528	24843	1.0247
Coastal	61	22248	22726	23338	24476	25017	25359	1.0253
Non-Coastal	6	17728	18093	18749	19549	19554	19600	1.0193
Georgia	159	20007	20601	20878	21545	22020	22229	1.0205
Coastal	28	18733	19224	19418	19922	20265	20455	1.0178
Non-Coastal	131	20280	20895	21190	21892	22395	22609	1.0211
Louisiana	64	18725	19054	19502	19952	19956	19893	1.0114
Coastal	38	19401	19690	20422	21121	20861	20945	1.0151
Non-Coastal	26	17738	18126	18157	18243	18633	18356	1.0061
Mississippi	82	17309	17894	18395	18917	19013	19134	1.0198
Coastal	12	17091	17480	18005	18884	18864	19131	1.0225
Non-Coastal	70	17347	17966	18461	18923	19038	19135	1.0193
North Carolina	100	21426	22007	22874	23516	23736	24380	1.0259
Coastal	37	20069	20883	21623	21759	21477	22620	1.0240
Non-Coastal	63	22222	22666	23609	24547	25063	25414	1.0270
South Carolina	46	19599	20004	20692	21470	21950	22376	1.0265
Coastal	22	18580	19135	19663	20332	20843	21328	1.0273
Non-Coastal	24	20532	20800	21635	22513	22964	23337	1.0259
Non-Coastal States								
Arkansas	75	18528	19036	19447	19916	20176	20016	1.0153
Kentucky	120	18012	18557	19259	19817	20048	20976	1.0305
Tennessee	95	20074	20164	20745	21356	21767	22152	1.0199
West Virginia	55	17901	18171	18621	19229	19315	19715	1.0193

Table A.12 Coastal Differences in Average Number of People Employed and Its Average Annual Rate of Change, by State, 1995 - 2000

State	No. of counties	Average of the Total Number of People Employed						EMPGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	28702	29347	30023	30569	31085	31539	1.0153
Coastal	206	50012	51261	52758	53941	55003	55721	1.0191
Non-Coastal	724	22638	23112	23554	23920	24280	24658	1.0142
Coastal States								
Alabama	67	29192	29741	30375	30736	30899	30938	1.0087
Coastal	8	38616	39515	40577	40981	41182	39883	1.0099
Non-Coastal	59	27914	28416	28992	29347	29504	29725	1.0085
Florida	67	99336	101896	105085	107946	110473	112816	1.0276
Coastal	61	106396	109171	112636	115737	118496	120839	1.0276
Non-Coastal	6	27553	27932	28307	28731	28906	31246	1.0277
Georgia	159	22157	22882	23596	24287	24853	25686	1.0246
Coastal	28	12961	13248	13593	13733	13959	14358	1.0227
Non-Coastal	131	24122	24941	25734	26543	27182	28107	1.0251
Louisiana	64	28443	28992	29533	29983	30105	30115	1.0095
Coastal	38	37716	38592	39491	40173	40182	40319	1.0170
Non-Coastal	26	14891	14960	14979	15090	15378	15202	0.9984
Mississippi	82	14333	14476	14645	14775	14923	15170	1.0119
Coastal	12	19511	19975	20332	20864	21518	21546	1.0227
Non-Coastal	70	13445	13533	13670	13731	13793	14077	1.0101
North Carolina	100	35827	37041	38096	38448	39212	39594	1.0157
Coastal	37	21426	21976	22590	22604	23108	23033	1.0089
Non-Coastal	63	44284	45889	47203	47753	48671	49320	1.0197
South Carolina	46	38144	38818	39555	40197	40802	41215	1.0118
Coastal	22	30931	31544	32343	33009	33723	33791	1.0131
Non-Coastal	24	44756	45486	46165	46787	47292	48021	1.0106
Non-Coastal States								
Arkansas	75	14643	14811	15082	15273	15452	15590	1.0127
Kentucky	120	27095	27484	27790	28265	28654	28944	1.0150
Tennessee	95	15608	15720	15695	15725	15974	16046	1.0043
West Virginia	55	13162	13377	13572	13721	13862	13910	1.0164

Table A.13 Coastal Differences in Average Number of Establishments and Its Average Annual Rate of Change, by State, 1995 - 2000

State	No. of counties	Average of the Total Number of Establishments						ESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	1513	1549	1596	1606	1620	1629	1.0152
Coastal	206	2866	2937	3018	3039	3064	3086	1.0172
Non-Coastal	724	1128	1155	1191	1198	1209	1214	1.0146
Coastal States								
Alabama	67	1433	1465	1496	1497	1500	1489	1.0031
Coastal	8	2021	2074	2106	2105	2121	2097	1.0025
Non-Coastal	59	1353	1382	1413	1414	1415	1407	1.0031
Florida	67	5943	6079	6231	6278	6329	6393	1.0149
Coastal	61	6387	6536	6701	6752	6810	6879	1.0177
Non-Coastal	6	1432	1440	1451	1451	1442	1454	0.9865
Georgia	159	1126	1159	1203	1221	1244	1260	1.0253
Coastal	28	680	700	721	729	729	732	1.0185
Non-Coastal	131	1221	1258	1306	1326	1353	1373	1.0268
Louisiana	64	1499	1533	1573	1571	1577	1575	1.0050
Coastal	38	2000	2045	2104	2106	2114	2114	1.0120
Non-Coastal	26	766	784	797	790	792	787	0.9949
Mississippi	82	696	708	723	728	729	728	1.0084
Coastal	12	889	940	969	972	978	984	1.0286
Non-Coastal	70	663	668	681	687	687	685	1.0050
North Carolina	100	1820	1879	1975	1987	2017	2039	1.0184
Coastal	37	1127	1156	1200	1209	1218	1217	1.0140
Non-Coastal	63	2226	2304	2429	2443	2486	2521	1.0210
South Carolina	46	1912	1963	2041	2064	2096	2111	1.0232
Coastal	22	1692	1744	1817	1840	1875	1892	1.0281
Non-Coastal	24	2115	2164	2248	2271	2298	2312	1.0188
Non-Coastal States								
Arkansas	75	709	724	742	746	749	749	1.0199
Kentucky	120	1314	1343	1378	1380	1380	1377	1.0093
Tennessee	95	803	817	831	831	836	842	1.0137
West Virginia	55	738	746	756	758	753	746	1.0118

Table A.14 Coastal Differences in Average Small Sized Establishments and Its Average Annual Rate of Change, by State, 1995 - 2000

State	No. of counties	Average of the Total Number of Small Sized Establishments						SESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	1313	1345	1385	1390	1399	1402	1.0107
Coastal	206	2520	2582	2653	2665	2684	2697	1.0138
Non-Coastal	724	970	993	1024	1027	1033	1034	1.0098
Coastal States								
Alabama	67	1235	1262	1288	1286	1285	1274	1.0053
Coastal	8	1755	1798	1822	1816	1823	1810	1.0023
Non-Coastal	59	1165	1189	1216	1214	1212	1201	1.0057
Florida	67	5255	5377	5512	5543	5582	5629	1.0144
Coastal	61	5647	5781	5928	5962	6007	6057	1.0155
Non-Coastal	6	1265	1271	1282	1279	1261	1279	1.0031
Georgia	159	965	994	1031	1045	1062	1072	1.0203
Coastal	28	595	612	630	636	636	635	1.0152
Non-Coastal	131	1044	1075	1117	1132	1153	1166	1.0214
Louisiana	64	1287	1315	1350	1340	1346	1342	1.0091
Coastal	38	1711	1749	1797	1789	1798	1795	1.0136
Non-Coastal	26	666	682	695	684	686	681	1.0026
Mississippi	82	608	618	630	633	633	630	1.0041
Coastal	12	788	833	856	853	853	856	1.0202
Non-Coastal	70	577	581	591	596	595	591	1.0013
North Carolina	100	1567	1619	1702	1707	1727	1740	1.0177
Coastal	37	992	1018	1056	1063	1067	1061	1.0112
Non-Coastal	63	1904	1972	2081	2085	2115	2139	1.0215
South Carolina	46	1663	1704	1768	1783	1806	1810	1.0120
Coastal	22	1487	1530	1590	1609	1637	1641	1.0130
Non-Coastal	24	1824	1864	1931	1943	1961	1966	1.0111
Non-Coastal States								
Arkansas	75	607	621	635	638	638	634	1.0081
Kentucky	120	1119	1144	1172	1168	1164	1156	1.0096
Tennessee	95	703	715	727	724	728	730	1.0045
West Virginia	55	649	657	662	664	659	650	0.9994

Table A.15 Coastal Differences in Average Number of Medium Sized Establishments and Its Average Annual Rate of Change, by State, 1995 - 2000

State	No. of counties	Average of the Total Number of Medium Sized Establishments						MESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	164	168	174	178	181	186	1.0250
Coastal	206	289	296	304	310	315	323	1.0296
Non-Coastal	724	129	132	137	140	143	147	1.0237
Coastal States								
Alabama	67	162	166	172	174	177	177	1.0088
Coastal	8	222	230	240	242	249	240	1.0140
Non-Coastal	59	154	157	162	164	167	169	1.0080
Florida	67	574	582	593	603	611	625	1.0159
Coastal	61	616	625	637	648	656	672	1.0211
Non-Coastal	6	142	142	142	144	151	145	0.9624
Georgia	159	132	135	140	144	147	153	1.0378
Coastal	28	71	74	76	79	79	82	1.0407
Non-Coastal	131	145	148	154	158	162	168	1.0372
Louisiana	64	179	183	188	195	194	197	1.0156
Coastal	38	243	249	258	267	265	270	1.0246
Non-Coastal	26	85	86	86	91	91	90	1.0024
Mississippi	82	71	73	76	78	79	82	1.0220
Coastal	12	84	91	96	101	106	111	1.0643
Non-Coastal	70	69	70	73	74	74	77	1.0147
North Carolina	100	205	212	223	229	237	245	1.0342
Coastal	37	115	117	123	125	131	134	1.0293
Non-Coastal	63	258	268	282	290	300	310	1.0371
South Carolina	46	204	212	226	231	238	248	1.0326
Coastal	22	173	180	191	192	200	211	1.0350
Non-Coastal	24	233	241	258	266	274	282	1.0303
Non-Coastal States								
Arkansas	75	84	84	87	89	91	94	1.0236
Kentucky	120	159	162	168	172	175	180	1.0264
Tennessee	95	82	84	85	88	89	92	1.0203
West Virginia	55	74	75	80	80	80	82	1.0181

Table A.16 Coastal Differences in Average Number of Large Sized Establishments and Its Average Annual Rate of Change, by State, 1995 -2000

State	No. of counties	Average of the Total Number of Large Sized Establishments						LESTGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	35	36	37	39	40	41	1.0098
Coastal	206	57	59	62	64	65	67	1.0082
Non-Coastal	724	29	30	31	31	32	33	1.0102
Coastal States								
Alabama	67	36	37	36	37	38	38	0.9952
Coastal	8	44	46	44	47	49	47	0.9914
Non-Coastal	59	35	36	35	36	36	37	0.9957
Florida	67	115	120	127	132	136	140	1.0144
Coastal	61	124	129	136	142	146	150	1.0164
Non-Coastal	6	25	26	27	27	30	31	0.9941
Georgia	159	29	31	32	32	35	36	1.0179
Coastal	28	14	15	14	15	15	15	0.9996
Non-Coastal	131	32	34	35	36	39	40	1.0218
Louisiana	64	34	35	35	36	36	36	0.9904
Coastal	38	46	48	49	49	50	49	0.9977
Non-Coastal	26	15	16	15	15	15	16	0.9798
Mississippi	82	17	17	17	17	17	17	0.9993
Coastal	12	16	17	18	18	18	17	1.0013
Non-Coastal	70	17	17	17	17	17	17	0.9990
North Carolina	100	48	48	50	51	52	53	1.0033
Coastal	37	20	21	21	21	21	22	1.0015
Non-Coastal	63	64	65	66	69	71	72	1.0044
South Carolina	46	45	47	47	51	52	53	1.0250
Coastal	22	32	35	36	38	39	40	1.0361
Non-Coastal	24	58	58	58	62	64	65	1.0149
Non-Coastal States								
Arkansas	75	18	18	19	20	20	21	1.0280
Kentucky	120	36	37	39	40	41	42	0.9918
Tennessee	95	18	18	18	19	19	20	1.0163
West Virginia	55	14	14	13	14	14	14	1.0180

Table A.17 Coastal Differences in Average Population Density per Square Mile and Its Average Annual Rate of Change, 1995 -2000

State by RUC	No of Counties	Average Population Density per Square Mile						DENGRO
		1995	1996	1997	1998	1999	2000	
Southeast	930	117	118	119	121	122	124	1.0099
Coastal	206	161	162	164	166	167	169	1.0112
Non-Coastal	724	104	105	107	108	109	111	1.0096
Coastal States								
Alabama	67	78	78	79	80	80	80	1.0054
Coastal	8	70	70	71	71	72	72	1.0060
Non-Coastal	59	79	80	80	81	81	81	1.0053
Florida	67	245	249	253	256	260	263	1.0165
Coastal	61	261	265	269	274	277	280	1.0170
Non-Coastal	6	80	81	82	82	83	83	1.0116
Georgia	159	139	142	145	148	151	154	1.0170
Coastal	28	64	65	66	67	67	68	1.0127
Non-Coastal	131	155	159	162	165	169	172	1.0179
Louisiana	64	142	143	143	143	143	143	1.0032
Coastal	38	206	206	206	206	207	207	1.0055
Non-Coastal	26	49	50	50	50	49	49	0.9997
Mississippi	82	55	55	56	56	57	57	1.0058
Coastal	12	78	79	80	81	82	83	1.0137
Non-Coastal	70	51	51	52	52	52	53	1.0044
North Carolina	100	147	149	152	154	156	158	1.0131
Coastal	37	107	108	110	111	112	112	1.0085
Non-Coastal	63	170	173	177	180	183	185	1.0159
South Carolina	46	110	111	113	114	115	117	1.0085
Coastal	22	93	94	95	96	97	98	1.0085
Non-Coastal	24	126	128	129	131	132	134	1.0085
Non-Coastal States								
Arkansas	75	45	46	46	47	47	47	1.0049
Kentucky	120	100	101	102	103	103	104	1.0087
Tennessee	95	111	113	114	116	117	118	1.0136
West Virginia	55	95	95	95	95	95	94	0.9996

Table A.18 Coastal Differences in Average Number of People In- and Out-Migrated from 1995 to 2000 and Migration Rates

State by RUC	No of Counties	Average Inflow		Average Outflow	
		Number	Rate	Number	Rate
Southeast	930	12790	38.0782	11063	161.4454
Coastal	206	22883	40.9794	19834	168.5189
Non-Coastal	724	9919	37.2528	8567	159.4328
Coastal States					
Alabama	67	10329	31.1398	9944	151.5464
Coastal	8	11458	26.5329	11666	142.8096
Non-Coastal	59	10176	31.7644	9710	152.7311
Florida	67	47354	52.1379	38294	182.0612
Coastal	61	50120	51.7624	40603	181.8283
Non-Coastal	6	19238	55.9550	14823	184.4285
Georgia	159	12643	45.8833	10500	178.0323
Coastal	28	7226	44.9669	6527	179.5564
Non-Coastal	131	13801	46.0792	11350	177.7066
Louisiana	64	10025	30.3977	11209	155.2792
Coastal	38	12992	30.1292	14528	149.4042
Non-Coastal	26	5689	30.7902	6357	163.8657
Mississippi	82	5805	31.8303	5476	153.2823
Coastal	12	9490	36.9946	8217	156.8488
Non-Coastal	70	5173	30.9450	5007	152.6709
North Carolina	100	16580	40.5691	13201	158.1967
Coastal	37	11403	38.7587	10832	173.5817
Non-Coastal	63	19621	41.6323	14593	149.1610
South Carolina	46	16423	35.1521	13549	150.6671
Coastal	22	15138	35.9088	12793	157.7837
Non-Coastal	24	17601	34.4584	14242	144.1435
Non-Coastal Counties					
Arkansas	75	6839	38.3339	6278	185.9025
Kentucky	120	5713	34.7456	5429	153.9879
Tennessee	95	10860	38.7524	9320	146.0792
West Virginia	55	4703	28.7682	4898	144.1684

Table A.19 Coastal Differences in Average for Human Development Index or County Well-Being Index, by State, 2000

State by RUC	No of Counties	Human Development Index		
		EDUC_00	ECON_00	HOUS_00
Southeast	930	0.3787	0.5418	0.1657
Coastal	206	0.4006	0.5426	0.1834
Non-Coastal	724	0.3724	0.5415	0.1606
Coastal States				
Alabama	67	0.3109	0.5249	0.1458
Coastal	8	0.3445	0.5176	0.1680
Non-Coastal	59	0.3063	0.5258	0.1428
Florida	67	0.4304	0.6003	0.1586
Coastal	61	0.4347	0.6117	0.1686
Non-Coastal	6	0.3870	0.4851	0.0569
Georgia	159	0.3485	0.5009	0.1384
Coastal	28	0.3526	0.4445	0.1037
Non-Coastal	131	0.3477	0.5129	0.1458
Louisiana	64	0.3902	0.5264	0.2197
Coastal	38	0.4104	0.6053	0.2862
Non-Coastal	26	0.3606	0.4110	0.1224
Mississippi	82	0.3300	0.5155	0.1979
Coastal	12	0.3672	0.5733	0.2782
Non-Coastal	70	0.3236	0.5056	0.1842
North Carolina	100	0.3862	0.5374	0.1812
Coastal	37	0.4005	0.4170	0.1257
Non-Coastal	63	0.3778	0.6081	0.2138
South Carolina	46	0.3850	0.6332	0.2158
Coastal	22	0.3893	0.5712	0.1990
Non-Coastal	24	0.3811	0.6901	0.2312
Non-Coastal States				
Arkansas	75	0.4371	0.5472	0.2000
Kentucky	120	0.4060	0.5690	0.1217
Tennessee	95	0.3463	0.5197	0.1052
West Virginia	55	0.4419	0.5691	0.2496

Table A.20 Coastal Differences in Average for All Exogenous Variables of the Model

State by RUC	No of Counties	Demographic Characteristics			Socioeconomic Level			Urban Transition
		LNNATINC	MEDAGE	RACE	ECON_90	EDUC_90	HOUS_90	LNGRAV
Southeast	930	3.0222	35	0.4331	0.5510	0.3819	0.1592	12.1649
Coastal	206	0.3255	34	0.5429	0.5649	0.4056	0.1833	12.6294
Non-Coastal	724	0.2448	35	0.4019	0.5470	0.3752	0.1523	12.0328
Coastal States								
Alabama	67	3.1109	34	0.6991	0.5438	0.3344	0.1340	12.7242
Coastal	8	0.2743	35	0.4464	0.5534	0.3636	0.1458	12.6739
Non-Coastal	59	0.2640	34	0.7334	0.5425	0.3305	0.1323	12.7310
Florida	67	1.5181	37	0.3536	0.5736	0.4237	0.1704	13.5212
Coastal	61	0.1385	38	0.3452	0.5829	0.4227	0.1804	13.6174
Non-Coastal	6	0.1439	35	0.4380	0.4789	0.4339	0.0692	12.5437
Georgia	159	4.9517	33	0.5893	0.4927	0.3851	0.1265	12.0967
Coastal	28	0.5162	32	0.4969	0.4619	0.4032	0.0967	11.9089
Non-Coastal	131	0.4127	34	0.6091	0.4992	0.3813	0.1329	12.1368
Louisiana	64	4.6795	32	0.6084	0.6170	0.3934	0.2042	12.5216
Coastal	38	0.5448	32	0.5581	0.6799	0.4038	0.2707	13.2119
Non-Coastal	26	0.2059	33	0.6819	0.5251	0.3782	0.1071	11.5127
Mississippi	82	4.4053	32	0.9607	0.5843	0.4035	0.1952	11.8875
Coastal	12	0.3517	33	0.5771	0.6293	0.4574	0.2583	12.2999
Non-Coastal	70	0.3548	32	1.0265	0.5766	0.3943	0.1844	11.8169
North Carolina	100	2.9837	36	0.4371	0.5917	0.3366	0.1824	12.5999
Coastal	37	0.2237	35	0.6679	0.5031	0.3625	0.1373	11.2978
Non-Coastal	63	0.2727	36	0.3016	0.6437	0.3215	0.2089	13.3647
South Carolina	46	3.9751	34	0.7793	0.5725	0.3987	0.2158	12.3439
Coastal	22	0.3982	33	0.9290	0.5204	0.4240	0.2004	12.2036
Non-Coastal	24	0.3020	34	0.6420	0.6203	0.3755	0.2299	12.4726
Non-Coastal States								
Arkansas	75	1.5011	36	0.2907	0.5668	0.3825	0.1874	11.3200
Kentucky	120	2.4541	35	0.0523	0.5531	0.3980	0.1195	11.7397
Tennessee	95	1.9659	36	0.1221	0.5001	0.3316	0.0983	12.5462
West Virginia	55	-0.4110	37	0.0299	0.5437	0.4535	0.2284	10.5077

APPENDIX B

LIST OF COASTAL COUNTIES

List B.1 List of Atlantic Coastal Counties

No.	State	County Name	Coast
1	Florida	Baker County	Atlantic
2	Florida	Brevard County	Atlantic
3	Florida	Broward County	Atlantic
4	Florida	Clay County	Atlantic
5	Florida	Duval County/City of Jacksonville	Atlantic
6	Florida	Flagler County	Atlantic
7	Florida	Hendry County	Atlantic
8	Florida	Indian River County	Atlantic
9	Florida	Lake County	Atlantic
10	Florida	Martin County	Atlantic
11	Florida	Miami-Dade County	Atlantic
12	Florida	Nassau County	Atlantic
13	Florida	Okeechobee County	Atlantic
14	Florida	Orange County	Atlantic
15	Florida	Osceola County	Atlantic
16	Florida	Palm Beach County	Atlantic
17	Florida	Putnam County	Atlantic
18	Florida	Seminole County	Atlantic
19	Florida	St. Johns County	Atlantic
20	Florida	St. Lucie County	Atlantic
21	Florida	Volusia County	Atlantic
22	Georgia	Appling County	Atlantic
23	Georgia	Atkinson County	Atlantic
24	Georgia	Bacon County	Atlantic
25	Georgia	Brantley County	Atlantic
26	Georgia	Bryan County	Atlantic
27	Georgia	Bulloch County	Atlantic
28	Georgia	Camden County	Atlantic
29	Georgia	Charlton County	Atlantic
30	Georgia	Chatham County	Atlantic
31	Georgia	Coffee County	Atlantic
32	Georgia	Effingham County	Atlantic
33	Georgia	Glynn County	Atlantic
34	Georgia	Irwin County	Atlantic
35	Georgia	Jeff Davis County	Atlantic
36	Georgia	Jenkins County	Atlantic
37	Georgia	Liberty County	Atlantic
38	Georgia	Long County	Atlantic
39	Georgia	McIntosh County	Atlantic

No.	State	County Name	Coast
40	Georgia	Montgomery County	Atlantic
41	Georgia	Pierce County	Atlantic
42	Georgia	Screven County	Atlantic
43	Georgia	Tattnall County	Atlantic
44	Georgia	Toombs County	Atlantic
45	Georgia	Ware County	Atlantic
46	Georgia	Wayne County	Atlantic
47	Georgia	Anson County	Atlantic
48	North Carolina	Beaufort County	Atlantic
49	North Carolina	Bertie County	Atlantic
50	North Carolina	Bladen County	Atlantic
51	North Carolina	Brunswick County	Atlantic
52	North Carolina	Camden County	Atlantic
53	North Carolina	Carteret County	Atlantic
54	North Carolina	Chowan County	Atlantic
55	North Carolina	Columbus County	Atlantic
56	North Carolina	Craven County	Atlantic
57	North Carolina	Cumberland County	Atlantic
58	North Carolina	Currituck County	Atlantic
59	North Carolina	Dare County	Atlantic
60	North Carolina	Duplin County	Atlantic
61	North Carolina	Edgecombe County	Atlantic
62	North Carolina	Gates County	Atlantic
63	North Carolina	Halifax County	Atlantic
64	North Carolina	Hertford County	Atlantic
65	North Carolina	Hyde County	Atlantic
66	North Carolina	Jones County	Atlantic
67	North Carolina	Lenoir County	Atlantic
68	North Carolina	Martin County	Atlantic
69	North Carolina	New Hanover County	Atlantic
70	North Carolina	Northampton County	Atlantic
71	North Carolina	Onslow County	Atlantic
72	North Carolina	Pamlico County	Atlantic
73	North Carolina	Pasquotank County	Atlantic
74	North Carolina	Pender County	Atlantic
75	North Carolina	Perquimans County	Atlantic
76	North Carolina	Pitt County	Atlantic
77	North Carolina	Richmond County	Atlantic
78	North Carolina	Sampson County	Atlantic
79	North Carolina	Scotland County	Atlantic
80	North Carolina	Tyrrell County	Atlantic

No.	State	County Name	Coast
81	North Carolina	Washington County	Atlantic
82	North Carolina	Wayne County	Atlantic
83	North Carolina	Wilson County	Atlantic
84	South Carolina	Allendale County	Atlantic
85	South Carolina	Beaufort County	Atlantic
86	South Carolina	Berkeley County	Atlantic
87	South Carolina	Charleston County	Atlantic
88	South Carolina	Chesterfield County	Atlantic
89	South Carolina	Clarendon County	Atlantic
90	South Carolina	Colleton County	Atlantic
91	South Carolina	Darlington County	Atlantic
92	South Carolina	Dillon County	Atlantic
93	South Carolina	Dorchester County	Atlantic
94	South Carolina	Florence County	Atlantic
95	South Carolina	Georgetown County	Atlantic
96	South Carolina	Hampton County	Atlantic
97	South Carolina	Horry County	Atlantic
98	South Carolina	Jasper County	Atlantic
99	South Carolina	Kershaw County	Atlantic
100	South Carolina	Lancaster County	Atlantic
101	South Carolina	Lee County	Atlantic
102	South Carolina	Marion County	Atlantic
103	South Carolina	Marlboro County	Atlantic
104	South Carolina	Sumter County	Atlantic
105	South Carolina	Williamsburg County	Atlantic

List B.2 List of Gulf of Mexico Coastal Counties

No.	State	County Name	Coast
106	Alabama	Baldwin County	Gulf of Mexico
107	Alabama	Clarke County	Gulf of Mexico
108	Alabama	Covington County	Gulf of Mexico
109	Alabama	Escambia County	Gulf of Mexico
110	Alabama	Geneva County	Gulf of Mexico
111	Alabama	Mobile County	Gulf of Mexico
112	Alabama	Monroe County	Gulf of Mexico
113	Alabama	Washington County	Gulf of Mexico
114	Florida	Bay County	Gulf of Mexico
115	Florida	Calhoun County	Gulf of Mexico
116	Florida	Charlotte County	Gulf of Mexico
117	Florida	Citrus County	Gulf of Mexico
118	Florida	Collier County	Gulf of Mexico
119	Florida	DeSoto County	Gulf of Mexico
120	Florida	Dixie County	Gulf of Mexico
121	Florida	Escambia County	Gulf of Mexico
122	Florida	Franklin County	Gulf of Mexico
123	Florida	Gadsden County	Gulf of Mexico
124	Florida	Gilchrist County	Gulf of Mexico
125	Florida	Glades County	Gulf of Mexico
126	Florida	Gulf County	Gulf of Mexico
127	Florida	Hardee County	Gulf of Mexico
128	Florida	Hernando County	Gulf of Mexico
129	Florida	Hillsborough County	Gulf of Mexico
130	Florida	Holmes County	Gulf of Mexico
131	Florida	Jackson County	Gulf of Mexico
132	Florida	Jefferson County	Gulf of Mexico
133	Florida	Lafayette County	Gulf of Mexico
134	Florida	Lee County	Gulf of Mexico
135	Florida	Leon County	Gulf of Mexico
136	Florida	Levy County	Gulf of Mexico
137	Florida	Liberty County	Gulf of Mexico
138	Florida	Madison County	Gulf of Mexico
139	Florida	Manatee County	Gulf of Mexico
140	Florida	Marion County	Gulf of Mexico
141	Florida	Monroe County	Gulf of Mexico
142	Florida	Okaloosa County	Gulf of Mexico
143	Florida	Pasco County	Gulf of Mexico
144	Florida	Pinellas County	Gulf of Mexico

No.	State	County Name	Coast
145	Florida	Polk County	Gulf of Mexico
146	Florida	Santa Rosa County	Gulf of Mexico
147	Florida	Sarasota County	Gulf of Mexico
148	Florida	Sumter County	Gulf of Mexico
149	Florida	Suwannee County	Gulf of Mexico
150	Florida	Taylor County	Gulf of Mexico
151	Florida	Wakulla County	Gulf of Mexico
152	Florida	Walton County	Gulf of Mexico
153	Florida	Washington County	Gulf of Mexico
154	Georgia	Decatur County	Gulf of Mexico
155	Georgia	Grady County	Gulf of Mexico
156	Georgia	Thomas County	Gulf of Mexico
157	Louisiana	Acadia Parish	Gulf of Mexico
158	Louisiana	Ascension Parish	Gulf of Mexico
159	Louisiana	Assumption Parish	Gulf of Mexico
160	Louisiana	Avoyelles Parish	Gulf of Mexico
161	Louisiana	Beauregard Parish	Gulf of Mexico
162	Louisiana	Calcasieu Parish	Gulf of Mexico
163	Louisiana	Cameron Parish	Gulf of Mexico
164	Louisiana	East Baton Rouge Parish	Gulf of Mexico
165	Louisiana	East Feliciana Parish	Gulf of Mexico
166	Louisiana	Evangeline Parish	Gulf of Mexico
167	Louisiana	Iberia Parish	Gulf of Mexico
168	Louisiana	Iberville Parish	Gulf of Mexico
169	Louisiana	Jefferson Davis Parish	Gulf of Mexico
170	Louisiana	Jefferson Parish	Gulf of Mexico
171	Louisiana	Lafayette Consolidated Government	Gulf of Mexico
172	Louisiana	Lafourche Parish	Gulf of Mexico
173	Louisiana	Livingston Parish	Gulf of Mexico
174	Louisiana	Orleans Parish	Gulf of Mexico
175	Louisiana	Plaquemines Parish	Gulf of Mexico
176	Louisiana	Pointe Coupee Parish	Gulf of Mexico
177	Louisiana	Rapides Parish	Gulf of Mexico
178	Louisiana	Sabine Parish	Gulf of Mexico
179	Louisiana	St. Bernard Parish	Gulf of Mexico
180	Louisiana	St. Charles Parish	Gulf of Mexico
181	Louisiana	St. Helena Parish	Gulf of Mexico
182	Louisiana	St. James Parish	Gulf of Mexico
183	Louisiana	St. John The Baptist Parish	Gulf of Mexico
184	Louisiana	St. Landry Parish	Gulf of Mexico
185	Louisiana	St. Martin Parish	Gulf of Mexico

No.	State	County Name	Coast
186	Louisiana	St. Mary Parish	Gulf of Mexico
187	Louisiana	St. Tammany Parish	Gulf of Mexico
188	Louisiana	Tangipahoa Parish	Gulf of Mexico
189	Louisiana	Terrebonne Parish	Gulf of Mexico
190	Louisiana	Vermilion Parish	Gulf of Mexico
191	Louisiana	Vernon Parish	Gulf of Mexico
192	Louisiana	Washington Parish	Gulf of Mexico
193	Louisiana	West Baton Rouge Parish	Gulf of Mexico
194	Louisiana	West Feliciana Parish	Gulf of Mexico
195	Mississippi	Amite County	Gulf of Mexico
196	Mississippi	George County	Gulf of Mexico
197	Mississippi	Hancock County	Gulf of Mexico
198	Mississippi	Harrison County	Gulf of Mexico
199	Mississippi	Jackson County	Gulf of Mexico
200	Mississippi	Lamar County	Gulf of Mexico
201	Mississippi	Marion County	Gulf of Mexico
202	Mississippi	Pearl River County	Gulf of Mexico
203	Mississippi	Pike County	Gulf of Mexico
204	Mississippi	Stone County	Gulf of Mexico
205	Mississippi	Walthall County	Gulf of Mexico
206	Mississippi	Wilkinson County	Gulf of Mexico