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EXAMINING RURAL-URBAN POPULATION CHANGE IN THE SOUTHEASTERN UNITED STATES*

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ABSTRACT

This study examined the factors that influenced population change in 875 counties in the southeastern United States between 1970 and 2000, using U.S. Census data. Binary logistic regression models were used to examine the relationship between socioeconomic factors and population change. The results of marginal probability estimates indicate that race and employment factors have been strongly related to population change in these counties. African-American-dominant counties have lost population to urban areas of more diverse counties. Our results suggest that individuals place high importance on better education, job opportunities, and living conditions in their decisions to move from their traditional places to new places. Additionally, rural counties need to develop resilience by improving community capital and quality of life amenities to sustain rural population and attract more retirees in rural corridors.

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Urban sprawl and rural rebound have both been observed and analyzed in many parts of the United States. Urban sprawl, also known as suburban sprawl, is the spreading outward of a city and its suburbs over rural land and its outskirts (Burchell 1998). It is characterized as low density, noncontiguous, automobile-dependent, residential, and nonresidential development that covers and consumes large amounts of farmland and natural areas. Urban sprawl has been recognized as an urban expansion augmented by the out-migration of young rural population, which leads to undesirable impacts in terms of sacrifice of farmland and loss of amenity benefits from open spaces on the urban fringe (Osman, Nawawi, and Abdullah 2008). Rural rebound is defined as the movement of people from urban areas to suburban regions (Johnson and Lichter 2007). Rural rebound has been observed in recent decades. Many researchers have considered it as a positive factor in reducing urban sprawl. However, such in-migration to rural counties has occurred more among retirees or older people who are not as active as an economically-productive population (Johnson 2006). An increase of members of a specific age group (especially of an older population) in rural counties may not contribute positively to rural development unless there are incentives to attract younger populations as well. Race has also become a factor for rural rebound, showing residential concentration of a specific race in certain locality.

Achieving a balance between rural rebound and urban sprawl is a subject of research for regional scientists and geographers and for those seeking balanced regional growth. Such balance is required because urban sprawl has challenged the stewardship of the agricultural labor force, farm lands, and food sufficiency in the rural areas over time. Similarly, an increasing trend of urban population growth has created demands for more services (e.g., drinking water, electricity, and infrastructure), and increased property values and taxes, as well as increased urban crime rates and pollution. Increased residential concentration of minority populations has posed another challenge in the urban centers, creating imbalances in property values, school districts, crime rates, and quality of life.

Past research has analyzed rural out-migration and its impacts on urban sprawl, residential segregation, quality of life, amenity factors, and sustainability (Albrecht 2010; Albrecht and Albrecht 2000; England and Brown 2003; Goe, Noonan, and Thurston 2003; Gyawali et al. 2010; Hancock 2001). Tobin (1999) suggested that demographic structure and out-migration to urban areas need to be carefully addressed if we are to attain any level of sustainability in urban communities as higher population growth trends in urban places may lead to increased disaster losses. A healthy community is one that has high levels of social, ecological, human,

and economic capital, collectively called community capital (England and Brown 2003; Hancock 1999). One challenge for rural communities in the twenty-first century is to increase all four forms of capital simultaneously, while also increasing rural immigration (Gyawali et al. 2010). Several factors influence migration patterns of both rural and urban people. For instance, increased availability of jobs in rural areas can offset rural to urban population migration (Albrecht 2010; Heer and Grigsby 1992). Therefore, changes in the level of job growth help us understand changes in population growth patterns (i.e., dynamics of rural rebound and urban sprawl) of specific regions (Pender 1998).

Recently, southeastern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee) have experienced higher rates of population increase than other regions in the nation. The major reason is an increase in in-migration to the metropolitan cities. Population has increased profoundly in the cities of Atlanta, Charlotte, Raleigh, Orlando, and Miami, as well as along the Gulf Coast. The growth in the population is a result of the growth of new businesses (such as the Delta hub in Atlanta), jobs, and infrastructure. The gradual growth of these major cities has attracted many new businesses and industries, and contributed to a conversion of farm and forestlands to urban and developed lands (Wear and Greis 2002).

Recent statistics of the southeastern states from U.S. Census 2010 suggest that the change in population between 1980 and 2000 represented an increase of 33 percent. The African-American, white, and "other" group population percentages were 21 percent, 76 percent, and 3 percent, respectively. There was a two-percent decline in white population and a two-percent increase in the "other" group population (mostly Hispanics) between 1980 and 2000. The average median household income in 2000 was $33,046 and average per capita income (PCI) for the same year was $16,741. The percentage of persons below the poverty line was 16.32 (compared with the national percentage of 12.7). The unemployment rate in the southeastern states in 2000 was 3.6 percent (the nationwide rate was 4.6 percent) (U.S. Census Bureau 2012). Similarly, over the past 30–50 years, the density of land used per person has declined drastically. Urbanized land has increased by 47 percent during the same period.

The growth in population and urban areas in the South has not resulted in significant changes in the quality of life of the southern people (Seong-Hoon et al. 2012; Sturgis 2011). Most of the population in the southeastern region is in poverty and has shown a decline especially in the younger generations of rural areas (Jensen, Findeis, and Wang 2000). The disparities in population change and income growth

between rural and urban counties have been important research topics for many years. These are some issues to be explored in this study.

The purpose of this study is to examine the factors correlated with population change in the southeastern United States. Utilizing historical U.S. population Census data, the study examines the historical trends of the relationship between change in population and socio-demographic variables from 1970 to 2000.

This paper is divided into five sections. In the next section, we review the existing literature on theories and recent studies of population change, and present our theoretical framework. In the methodology section, we describe the preparation of data and empirical models for analysis. The results and discussions section provides the results of the binary logistic regression that we conducted. The findings are summarized in the conclusion section.

LITERATURE REVIEW

In this section, major theories that explain population change and economic development are first discussed followed by the presentation of previous population change studies. Five population growth theories are discussed: (1) Malthusian Population Theory; (2) Boserup's Theory; (3) Growth Pole Theory; (4) Intersectionality Theory; and (5) Race and Ethnicity Theory.

Malthus' (1798) Population Theory stated that the world's population would increase in geometric proportions, but that food productions would increase only in an arithmetic proportion. Malthus argued that population would surpass the growth of our means of life. He contended that the imbalance between population growth and food production would lead to starvation and increased poverty. Contrariwise, Boserup (1981) proposed that technological advancement would increase global food production and feed the growing human population. She argued that Malthus failed to recognize the capability of human population and technological innovation to increase food production. Her argument was that farm mechanization and increased use of fertilizer would assist us in producing enough food to feed the growing human population.

The "growth pole strategy" is derived from Perroux's (1950) Theory, which states that as industries in an urban area expand, that further induces population growth and development of economic activities throughout the area's zone of influence. A growth pole development pattern induces a trickle down of development in employment generation, increased income, and productivity to its hinterland. It first stimulates demand in urban areas for the products of the rural

areas, and then stimulates the demand for urban goods and services in the rural areas.

Intersectionality Theory posits that "race, class, and gender" are socially defined (Steinburger, Press, and Dias 2006:808) and have effects on one's decision for migration. This theory asserts that power and privilege are determined by race, sex, and class-based social positions within society (Browne and Misra 2003; Collins 2000, 2005). For example, low-income Hispanic women may be less likely to migrate due to their low occupational aspirations. In support of this theory, traditional migration research assumes strong correlations between migration and both demographic and economic factors (Lee 1966; Ritchey 1976). Individuals decide to migrate to where the economic pulls or benefits appear the strongest. However, some individuals migrate for reasons that are not economic in nature (Massey et al. 1993). For example, retirees typically migrate to a new destination for better social amenities and health services (Irwin, Tolbert, and Lyson 1999; Nelson and Beyers 2002). Other individuals may be more likely to migrate because they find their current location to be culturally and/or socially confining due to their race, class, and/or gender status.

Population Studies in the South

Many studies have found diverse causes of population change ranging among geographical, social, economic, and political factors (Albrecht 2010; Duncan 1999; Nord and Cromartie 2000; Rural Sociological Society Taskforce on Persistent Rural Poverty 1993). Weber et al. (2005) have suggested that poverty rates are highest in the most urban and most rural areas of the southern United States. The authors stated that only one-fifth of the nation's 35 million poor people live in nonmetropolitan areas and that rural poverty has received less attention than urban poverty from both policymakers and researchers. Domina (2006) investigated the factors that have predicted migration between metro and nonmetro areas from 1989 to 2004 and found that economic factors are the driving forces of migration. Brown (2002) also recognized the role of economic factors, such as availability of high paying jobs in communities, in retaining current residents or attracting new migrants. Domina (2006) analyzed net annual nonmetro migration rates between the years 1989 and 2004 using a series of logistic regression analyses. The author found that the single most important factor that caused migration from nonmetro to metro areas was opportunity for better educational attainment and employment in metro areas. Burchfield et al. (2006) found, similarly, that urban population

growth is positively associated with employment and availability of public service transportation.

Schmitt et al. (2006) examined how the spatial pattern of urban growth influences the interplay of rural export employment, rural services employment, and population change in rural areas. Using an extension of Boarnet's model (Boarnet 1994), they found that spatial urban externalities (both dynamic and static) affect rural population and employment growth. In the regions where the urban core is declining and the urban fringe is expanding, urban population growth involves an increase in rural export employment, and greater change in service employment favors rural population growth (Schmitt et al. 2006).

Rodgers and Rodgers (1997) studied the effects of rural-to-urban moves and found a significant effect of rural out-migration on real annual earnings, hourly wages, and annual income within three to six years after such a move. The results support the idea that residential choice affects economic outcomes: living in a rural area increases the risk of being poor through the effects of local labor market characteristics and other factors. Fisher (2005) calls this effect endogeneity of residential choice with poverty.

Mills and Hazarika argued that "nonmetropolitan counties have consistently been concerned with retaining productive labor, given high migration propensities among educated young adults and the aging of retained populations" (2001:329). A study conducted by Johnson and Lichter (2008) documented the increasing contribution of immigrant population growth in rural America. They showed reports that some 297 rural counties of the nonmetro population experienced significant immigration for the first time in the 1990s. Their study showed that without the arrival of immigrants, the nonmetro counties would decline in population. Kandel and Cromartie (2004) also reported that Hispanic immigration has fueled rapid population increases in many rural areas. Morrison and Abrahamse's (1983) study focused on the effects of population change on commuting distances from metropolitan to nonmetropolitan areas. The findings relate to how workers are becoming repositioned in relation to their jobs as settlement patterns change.

Iceland (2004) explored residential segregation in the United States and indicated that segregation has been decreasing, mainly due to declines in black and white segregation. However, some level of segregation has been noticed among Asian and Pacific Islanders and the Hispanic population due to slight growth of these populations in metropolitan areas. People's preferences for living in neighborhoods with their ethnic group or, conversely, the desire to avoid another

particular group or groups also plays a key role, as suggested by Clark (2007). The author reported that whites have the strongest own-race preference in the rural South compared with minority groups. Emerson and Yancey (2001) found that, holding other factors constant, while Asian and Hispanic composition do not matter to whites buying a home, black neighborhood composition does.

Domina (2006) studied migration periods from 1989 to 2004 and found that the most important factor that caused migration between nonmetro and metro areas was educational attainment. Wenk and Hardesty (1993) studied the effect of rural-to-urban migration on time spent in poverty and time spent unemployed for young adults, and found that rural-to-urban moves reduce time spent in poverty and time spent unemployed for black and white populations.

Rodgers and Rodgers' (1997) study supports the idea that residential choice is related to economic outcomes: living in a rural area increases the risk of being poor through the effects of local labor market characteristics and other factors. Bolioli (2001) focused his study on causes of suburban sprawl and suggested that programs designed to stop sprawl should focus on specific age groups in a population to create more tailored programs. The study has shown that sprawl, or urban-rural migration, is not just the result of a behavior change, but also and more significantly, the result of changes in the age structure of the population.

Steady-state differences on educational attainment, industrial mix, and other structural factors are common in the southern United States. One factor for disparity between rural and urban population growth has been attributed to the industrial composition often found in rural areas. The specialization of rural areas in farming, mining, and sometimes manufacturing, in contrast to the urban areas, has been discussed in previous studies. Generally in the South, agriculture and natural resource sectors have been hit by competitive pressures and unfavorable commodity price swings since the 1970s. The effect has been declining employment and income levels in the rural counties triggering out-migration.

Literature broadly suggests that availability of jobs and better education opportunities in urban areas are the major driving factors of rural out-migration, especially among the younger generation (Brown 2002; Domina 2006). Past research has not provided historical or temporal explanations of the patterns of rural-urban or urban-rural migration and economic growth in the southeastern region, specifically in Black Belt, Appalachian, or Delta regions of the southeastern United States (Gyawali et al. 2008). Recent population and income growth in metropolitan cities in the southeastern region, as well as others along the Gulf Coast have shown specific spatial patterns and may have a connection to the

improvement in income growth and quality of life of rural areas, which may have long-term effects in bringing equilibrium in both population change and income growth between rural and urban counties in the southeastern United States.

STUDY AREA

Most of the studies on population change in the South are based on the states' or on multistate aggregate data, with few examinations at the county level (e.g., Albrecht 2010). The area chosen for this study consists of all 875 counties in the entire 10-state southeastern United States (Figure 1; Table 1). This region was selected because it represents unique sociocultural and economic attributes and indicates high contrast in demographics, urban structure, population growth, and industrial jobs with the rest of the United States. Also, this region constitutes the Black Belt region and has a higher proportion of African-American-dominant counties.

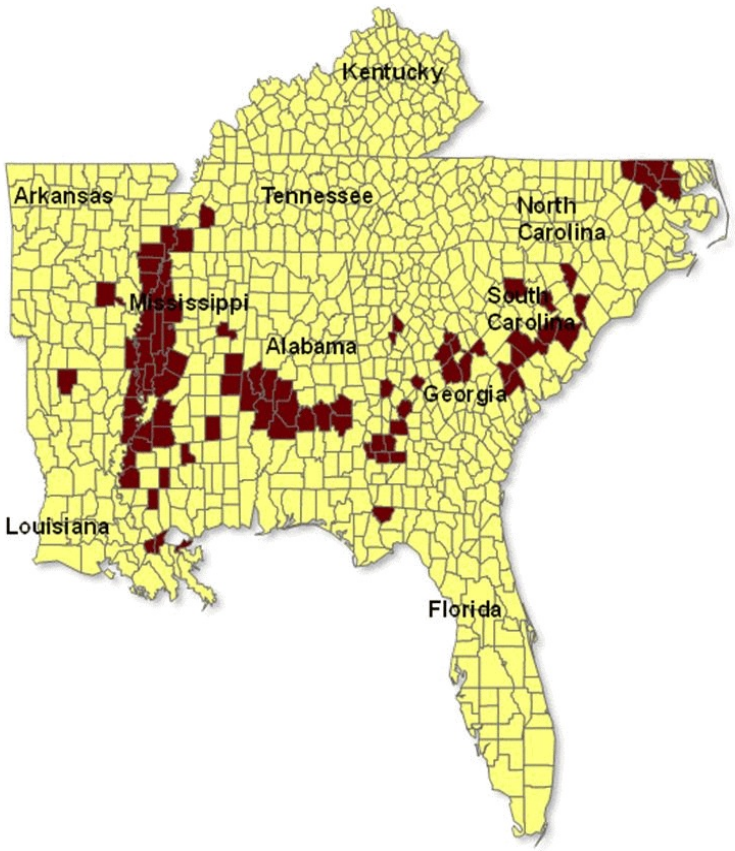

FIGURE 1. IN RED, AFRICAN-AMERICAN-DOMINANT COUNTIES IN THE SOUTHEASTERN UNITED STATES.

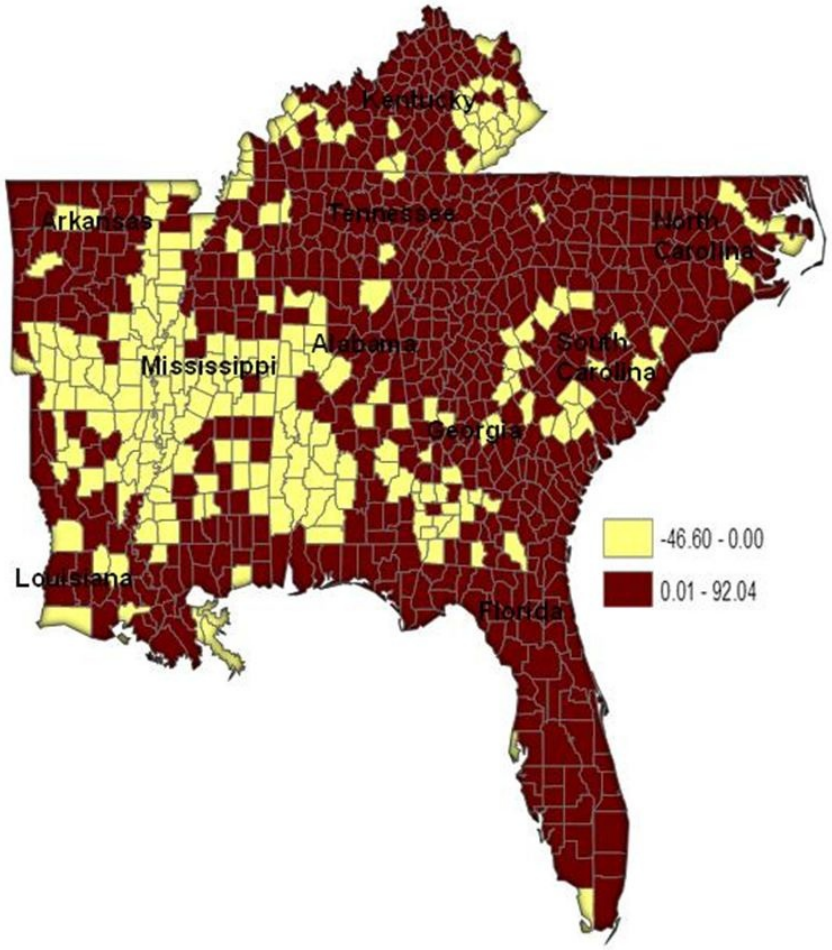

FIGURE 2. POPULATION GROWTH BETWEEN 1980 AND 2000 IN THE SOUTHEASTERN UNITED STATES.

METHODOLOGY

Historical data from 1970 to 2000 (at 10, 20, and 30-year intervals) at the county level were downloaded from the National Historical Geographical Information System (NHGIS) (Minnesota Population Center, 2011) and Social Explorer (http://www.socialexplorer.com/explore). Both Social Explorer and NHGIS have compiled the U.S. Census data in the disaggregated form, and allowed the flexibility of gathering multiple variables for 1970, 1980, and 2000. The downloaded data relate to demographic attributes (such as population, race, age, income, education, and urban and rural population), and industry and job attributes (employment and commuting distance).

TABLE 1. TOTAL NUMBER OF COUNTIES IN EACH STATE, 2000.

STATES	TOTAL COUNTIES
Alabama	67
Arkansas	75
Florida	67
Georgia	159
Kentucky	120
Louisiana	64
Mississippi	82
North Carolina	100
South Carolina	46
Tennessee	95
Total	875

Initially the raw data were downloaded in an Excel spreadsheet. Black Belt counties in the study region were distinguished as counties with a fifty-percent or more African-American population (based on year 2000 population). The remaining counties were labeled as other-dominant counties (Figure 1). Urban population within a county was defined as the number of people residing in the urban areas, whereas rural population was defined as the population in nonurban areas.[1] PCI data were not consistently available over the entire region for 1970, but were retained for analysis where available. Likewise, the 1970 and 1990 Censuses did not have sufficient data available for travel time, so this variable was omitted in the analysis. The authors intended to incorporate the 2010 Census data into the analysis, but the data corresponding to all identified variables were not made

[1]The Census Bureau introduced the "urban cluster" concept for Census 2000, replacing urban places located outside "urbanized areas." Urban clusters are defined based on the same criteria as urbanized areas, but include areas containing at least 2,500 and less than 50,000 people. "Rural" has continued to be defined as any population, housing, or territory outside urban areas (U.S. Bureau of the Census 2010), thus making the comparisons between 2000 and earlier censuses possible, at least insofar as this study is concerned. A summary of the most important differences between the 2000 and 1990 censuses can be found at http://www.census.gov/geo/reference/ua/uac2k_90.html.

accessible by the U.S. Census Bureau at the time of the study. Table 2 lists the description of all variables used in the analysis.

Empirical Model

The relationship between population change and socioeconomic variables is conceptualized in the following functional model: Population change (Y) = *f* (initial and changed conditions of demographic attributes, socioeconomic attributes, industry attributes, geographic attributes, environmental attributes, and spatial attributes). This conceptual/functional model is used to formulate mathematical models for further empirical analyses, which will be defined and discussed in the next section.

The binary logit regression model is specified to explore the probability of population increase in the southeastern United States between 1970 and 2000. This technique was chosen because population growth follows an exponential path as defined by logistic regression models. The following logit model was estimated (Greene 2003; Gujarati 1995; SPSS 1999):

$$L_i = \ln\left(\frac{P_t}{1-P_t}\right) = z_i = \beta_0 + \beta_1 X_{i,t-1} + \beta_2 (X_{i,t} - X_{i,t-1}) \ldots + \beta_n X_n \qquad (1)$$

where L_i denotes the natural logarithmic value of the odds of changes in population for 1970-2000, 1980-2000, and 1990-2000 in county *i*, respectively; $X_{i,t-1}$ is a vector of initial conditions of independent variables in 1970, 1980, and 1990, respectively; $(X_{i,t} - X_{i,t-1})$ is a vector of changed independent variables; P_t is the conditional probability of county *i*'s change in population given X_i; β_0 is a constant term; β_1 and β_2 denote parameters to be estimated. The independent variables are the initial and changed conditions of population (e.g., African Americans), education (high school and college graduates), age (labor force population and retirees), employed population, urban population, PCI, and travel time (Table 2).

To quantify the probability of correlations of independent variables on the dependent variable, marginal probability was calculated and interpreted as percentage of probability of correlation between dependent and independent variables (Banerjee et al. 2009; Greene 2003). The odds of the probability of population change are determined by the sign and magnitude of β_i. A negative

TABLE 2. DESCRIPTION OF VARIABLES USED IN POPULATION CHANGE MODEL

	DESCRIPTION
DEPENDENT VARIABLE	
Change in Total Population (Binary).	% of total population change in each county between 1970, 1980, 1990, and 2000 (1 = increase, 0 = no increase)
INDEPENDENT VARIABLES	
Initial Conditions	
African-American Population.	% African-American
Labor Force Participation.	% of 16-64 years
Retiree Population.	% of 65 or more years old
High School Population.	% of high school graduates
College Population.	% of holders of Bachelor's degree or above
Employed Population.	% of employed population at least 16 years old
Urban Population.	% of people in urban places within a county
Travel Time.	Initial (1980) average travel time to work (in minutes) per person in a county
Per Capita Income (PCI).	Initial PCI (1979, 1989)
Changed Conditions	
Changed African-American (AA) Population.	Difference in % of AA population
Changed Labor Force Population.	Difference in % of 16-64 age group population
Changed Retiree Population.	Difference in % of 65 and over age group population
Changed High School Population.	Difference in % of high school graduate population

TABLE 2. DESCRIPTION OF VARIABLES USED IN POPULATION CHANGE MODEL (*CONTINUED*)

INDEPENDENT VARIABLES	DESCRIPTION
Changed College Population.	Difference in % of Bachelor's degree holder population or over
Changed Employed Population. . . .	Difference in % of employed population
Changed Urban Population.	Difference in % of urban population within a county
Changed Travel Time.	Difference in average travel time to work (in minutes) per person in a county
Changed PCI.	Change in real PCI of each county in 2000 from PCI in 1980, 1990 (in 2000 dollar value)

estimate for β supports the assertion that the probability of population increase in a county is less likely to be related to the conditions of the independent variables, *ceteris paribus*. In other words, the negative β coefficients on independent variables indicate these variables have a lower probability of correlation with population increase relative to other variables (Banerjee et al. 2009).

Defining the Variables

Variable names and their definitions are presented in Table 2. The dependent variable (change in total population) is a dichotomous variable of *increase* or *no increase* in population in a county between 1970 and 2000 (in 10, 20, and 30-year intervals). A binary value of 1 was assigned for those counties whose population increased, and 0 for those counties whose population did not increase for the 10-year (1990-2000), 20-year (1980-2000) and 30-year (1970-2000) periods, respectively.

The independent variables are the initial and changed conditions of African-American population (AA), high school and college graduates, labor force population, retiree population, urban population, employed population, PCI, and travel time. The independent variables were chosen based on the findings of previous studies (e.g., Albrecht and Albrecht 2000; Burchfield et al. 2006; Domina 2006; Johnson and Lichter 2008). Disparity between rural and urban population growth has been attributed in part to the industrial composition often found in rural

areas (Gyawali et al. 2008). Previous studies indicated that employment and income levels in the rural counties are related to out-migration of younger populations to urban areas (Hammond 2006).

The population change (dependent variable) was derived using the following equation:

$$\Delta P_{j,(t,t-1)} = \frac{P_t - P_{t-1}}{P_{t-1}} \qquad (2)$$

In equation (2), P denotes population change for county j ($j = 1 \ldots n$) for the period between t and t-1, where t is a current year and t-1 is the beginning year for each interval (10, 20, or 30 years).

Equation (2) was also used to compute the changed variables (in percentages) between two periods. The AA, white, "other" race populations, labor force, young, retiree, employed population, and urban and rural populations, were totaled individually for 1970, 1980, 1990, and 2000, respectively, were then subtracted from the population in 2000 (i.e., population in 2000 - population in 1990, population in 2000 - population in 1980, population in 2000 - population in 1970), divided by population in the initial year (1990, 1980, and 1970, respectively), and multiplied by 100 to get the total percentage change in the corresponding period.

Before estimating the model, the variables were visually examined for outliers using histograms. In the current analysis, it was assumed that the data follow an approximately normal distribution (Gujarati 1995).

Multicollinearity Diagnostics

Multicollinearity can affect the inferential power of tests by inflating the variances of the estimates (Greene 2003; Vaus 2002). The multicollinearity effects among independent variables were analyzed using bivariate correlation coefficients, which were below 0.6 for all bivariate relationships. Additionally, a condition index was used to detect collinear relationships (Banerjee et al. 2009; Belsley, Kuh, and Welsch 1980). Usually, indices between 30 and 100 would indicate collinearity among the explanatory variables. Condition indices for the chosen explanatory variables were less than 30, thus indicating the interpretative power of the results (Vaus 2002).

RESULTS

Descriptive Statistics, between 1970 and 2000

The descriptive statistics table (Table 3) shows the minimum, maximum, mean, and change value of all major variables in 875 counties. There was a 97-percent increase in population in the study area over a 30-year period. The race variables are categorized into African-American, white, and other population. The white population shows a decline of 1.73 percent, and the African-American population shows an increase of 2 percent.

TABLE 3. DESCRIPTIVE STATISTICS FOR VARIABLES FOR 1970 AND 2000.

	MINIMUM		MAXIMUM		MEAN		PCT. CHANGE
VARIABLES	1970	2000	1970	2000	1970	2000	1970-2000
Total Population.	1,814	2,077	1,267,792	2,253,362	42,764	69,023	96.64
White(%).....	18.60	13.31	100.00	99.56	77.09	75.52	-1.73
AA(%).	0.00	0.00	81.10	86.13	22.66	21.25	2.02
Other(%).....	0.00	0.28	32.17	41.83	0.25	3.22	2,983.00
Young(%).	15.09	12.80	39.53	28.04	29.54	20.88	-28.87
Labor Force (%).	48.92	51.39	83.96	76.97	59.54	65.49	10.19
Retiree(%).....	0.45	1.80	35.00	34.72	59.54	13.63	30.69
High School(%).	5.78	15.87	40.86	47.43	21.03	34.34	79.46
College(%).....	1.08	4.86	31.79	44.10	5.90	13.26	142.31
Employed(%). ..	2.97	20.94	68.80	71.48	49.61	53.84	10.39
Rural (%).....	0.33	0.11	100.00	100.00	69.82	63.84	-4.70
Urban(%).....	0.00	0.00	99.67	99.89	6.42	36.16	63.58
Pop. Density....	2.50	4.09	1982.49	2,457.90	80.37	121.81	96.64

The population variable is categorized into young, labor force, and retiree population. Retirees are the most significant population in this class with a 31-percent increase followed by the young population, which decreased by 29 percent, and the labor force population, which increased by 10 percent. The education

category includes high school and college graduates. Both high school and college variables show a significant increase at 79 percent for high school and 142 percent for college. Employment is also a factor in population change and resulted in an increase of 10 percent. Rural population shows a decrease of 5 percent, while urban population shows an increase of 64 percent. Population density shows an increase of 97 percent over a 30-year period.

Descriptive Statistics, between 1980 and 2000

Total population shows a 52-percent increase over the 20-year period, 1980-2000 (Table 4). Only the white population shows decline in population, by 3 percent, over the 20-year period. African-American population increased by 54

TABLE 4. DESCRIPTIVE STATISTICS FOR VARIABLES FOR 1980 AND 2000.

	MINIMUM		MAXIMUM		MEAN		PCT. CHANGE
VARIABLES	1980	2000	1980	2000	1980	2000	1980-2000
Total Population.	2,032	2,077	1,625,781	2,253,362	51,853	69,023	51.51
White(%).....	15.04	13.31	99.99	99.56	77.87	75.52	-3.15
AA(%).	0.00	0.00	84.16	86.13	21.37	21.25	53.73
Other(%).....	0.00	0.28	35.45	41.83	0.75	3.22	662.52
Young(%).	15.83	12.80	41.01	28.04	30.34	20.88	-30.92
Labor Force (%)..	46.04	51.39	72.88	76.97	57.21	65.49	14.72
Retiree(%).....	0.81	1.80	33.96	34.72	12.45	13.63	12.20
High School(%). .	7.32	15.87	29.91	47.43	16.76	34.34	112.45
College(%).....	1.60	4.86	21.35	44.10	5.30	13.26	154.11
Employed(%). ...	8.42	20.94	70.66	71.48	51.35	53.84	5.49
Rural (%).....	0.08	0.11	100.00	100.00	67.65	63.84	1.96
Urban(%).....	0.00	0.00	99.92	99.89	32.35	36.16	31.61
Pop. Density.....	3.49	4.09	2542.29	2457.90	96.21	121.81	51.51
PCI.	6,756	9,629	21,614.00	32,496.00	12,164	16,265	34.22

percent, while "other" population increased by 663 percent over the 20-year period. The labor force population increased by 15 percent, the young population decreased by 31 percent, and the retiree population increased by 12 percent. Both high school and college populations show a significant increase at 112 percent and 154 percent, respectively. Employment is also a factor in population change and resulted in an increase of 5 percent. Rural population shows an increase of 2 percent, while urban population shows an increase of 32 percent. Population density shows an increase of 52 percent. Overall, the most significant variables changed are "other" groups of population, high school, and college population.

Descriptive Statistics, between 1990 and 2000

Total population shows a 34-percent increase in the study area over a 10-year period (Table 5). The white population shows the only decline in population, by 3 percent, the AA population increased by 18 percent, and "other" population increased by 315 percent. The labor force population increased by 2 percent, the young population decreased by 5 percent, and the retiree population decreased by 0.8 percent. The high school population shows a significant increase at 113 percent. The college population shows a 22-percent increase. Employed population declined by 8 percent over the 10-year period.

Rural population shows an increase of 4 percent, while urban population shows an increase of 35 percent. Population density shows an increase of 34 percent. An increase in PCI is observed at 20 percent over the 10-year period (1990-2000).

Table 6 represents the 875 counties in the southeastern United States that are AA-dominant. AA-dominant counties include those with 50 percent or greater African-American population. Alabama had the same number of AA-dominant counties in both 1970 and 2000, that is, no change occurred in the racial shift of a county from AA- to non-AA-dominant or vice versa over the 30-year period (1970-2000). Arkansas also had the same number of AA-dominant counties from 1970 to 2000. In Florida, AA-dominant counties decreased by one between 1970 and 2000 and exhibited no change between 1980 and 2000. Georgia showed the highest decline of AA-dominant counties by five counties in 1970-2000, two in 1980-2000, and three in 1990-2000, respectively. Kentucky was the only state with no AA-dominant county present in any of the years studied. Louisiana showed a decline of one county from 1970 to 2000, an increase of two between 1980 and 2000, and an increase of just one county in the 1990-2000 period. Mississippi and North Carolina were the only states that showed an increase in AA-dominant counties in

TABLE 5. DESCRIPTIVE STATISTICS FOR VARIABLES FOR 1990 AND 2000.

	MINIMUM		MAXIMUM		MEAN		PCT. CHANGE
VARIABLES	1990	2000	1990	2000	1990	2000	1990-2000
Total Population.	1,909	2,077	1,937,094	2,253,362	58,604	69,023	34.28
White(%).....	13.69	13.31	99.94	99.56	77.73	75.52	-2.97
AA(%).	0.00	0.00	86.24	86.13	21.13	21.25	17.82
Other(%).....	0.00	0.28	38.99	41.83	1.14	3.22	314.56
Young(%).	13.01	12.80	31.34	28.04	22.09	20.88	-5.08
Labor Force (%)..	50.82	51.39	76.58	76.97	64.00	65.49	2.43
Retiree(%).....	1.39	1.80	33.78	34.72	13.91	13.63	-0.80
High School(%). .	6.81	15.87	36.04	47.43	17.79	34.34	113.23
College(%).....	3.69	4.86	46.08	44.10	11.13	13.26	21.92
Employed(%). ...	18.48	20.94	79.64	71.48	58.55	53.84	-7.99
Rural (%).....	0.04	0.11	100.00	100.00	67.57	63.84	4.11
Urban(%).....	0.00	0.00	99.96	99.89	32.43	36.16	35.50
Pop. Density.....	3.80	4.09	3,029.10	2,457.90	107.22	121.81	34.28
PCI.	6,926	9,629	28,745.00	32,496.00	13,641	16,265	20.29

each period. Mississippi showed an increase of four in 1970-2000, an increase of three in 1980-2000, and an increase of one county in 1990-2000. North Carolina's AA-dominant counties increased by two from 1970-2000. This state gained one AA-dominant county in both the 10 and 20-year periods. South Carolina, on the other hand, showed no increase in AA-dominant counties between 1970 and 2000, or between 1990 and 2000. Yet, South Carolina lost one AA-dominant county in the 1980-2000 period. Tennessee showed no increase in AA-dominant counties between 1990 and 2000, but lost one AA-dominant county in both the 1970-2000 and 1980-2000 periods.

TABLE 6. AFRICAN-AMERICAN-DOMINANT COUNTIES BY STATE.

STATES	1970	2000	CHANGE	1980	2000	CHANGE	1990	2000	CHANGE
AL.	10	10	0	10	10	0	10	10	0
AR.	3	3	0	3	3	0	3	3	0
FL.	2	1	-1	1	1	0	1	1	0
GA.	22	17	-5	19	17	-2	20	17	-3
KY.	0	0	0	0	0	0	0	0	0
LA.	9	8	-1	6	8	2	7	8	1
MS.	21	25	4	22	25	3	24	25	1
NC.	5	7	2	6	7	1	6	7	1
SC.	12	12	0	13	12	-1	12	12	0
TN.	2	1	-1	2	1	-1	1	1	0
Total. . .	86	84	-2	82	84	2	84	84	0

RESULTS AND DISCUSSIONS

The results of the population increase models were explored to understand the probability of increase in the population in the southeastern United States between 1970 and 2000, between 1980 and 2000, and between 1990 and 2000, respectively. Using Pindyck and Rubinfeld's (1976) recommendation, the estimated results were interpreted by solving for the change in probability (ΔP_i) at the mean:

$$\sum \frac{\Delta p_i}{n} = \left(\frac{1}{n}\right) \sum \beta \left[p_i (1 - p_i) \right]$$

where P_i is the estimated probability of increase in population in each county, β is the estimated coefficient for a parameter, and n is the number of observations. The change in probability depends on the probability itself and when multiplied by 100 is the percentage change in the probability of the event occurring given a change in the variable, *ceteris paribus* (Bell et al. 1994; Jarvis 1990; Pindyck and Rubinfeld 1976).

Results of 1970-2000 Population Change Model

Table 7 shows the results of the binary logit model for 1970-2000. The Nagelkerke R^2 is 44.6 percent. This shows that a strong relationship exists between

TABLE 7. RESULTS OF BINARY LOGIT MODEL (1970 AND 2000).

VARIABLES	β COEFF.	STD. ERR.	WALD STAT.	EXP(β)	MARGINAL PROB.
Initial Conditions					
African-American.	-0.06**	0.01	32.19	0.95	-0.01
Labor Force.	0.25*	0.09	7.15	1.28	0.04
Retiree.	0.00	0.08	0.00	1.00	0.00
High School.	-0.04	0.05	0.09	0.96	-0.01
College.	0.06	0.08	0.46	1.06	0.01
Employed.	0.15**	0.03	26.39	1.16	0.03
Urban.	-0.03*	0.01	8.54	0.97	-0.01
Changed Conditions					
African-American.	-0.03	0.02	1.86	0.97	-0.01
Labor Force.	0.22*	0.10	4.70	1.25	0.04
Retiree.	-0.03	0.09	0.11	0.97	-0.01
High School.	0.00	0.04	0.01	1.00	0.00
College.	0.21*	0.07	8.37	1.23	0.04
Employed.	0.06	0.04	2.73	1.07	0.01
Urban.	0.00	0.01	0.01	1.00	0.00
Constant.	-19.54	7.36	7.05	0.00	

NOTE: $^{*}p \leq .05$; $^{**}p \leq .01$

the probability of an increase in the population in a county and the independent variables. The results are conveniently interpreted based on the estimated marginal probability of population increase for a county for a given time-period. Among the initial condition variables (1970), AA population and employed population are significant at the 1-percent level, and the labor force and urban population variables are significant at the 5-percent level. Among the changed variables, changed labor force and changed college population are both significant at the 5-percent level. Initial AA population shows a negative coefficient with the population increase. The marginal probability (-0.01) for the AA population suggests that a higher

percentage of the AA population in a given county is 1 percent less likely to be associated with population increase (left-hand-side variable) than the other counties. Initial labor force shows a positive coefficient with the population increase, suggesting that a higher percentage of the labor force in a county is 4.2 percent more likely to be correlated with the population increase than other counties. Likewise, the marginal probability (0.03) of the initial employed population indicates that a higher percentage of the employed population in any given county is 3 percent more likely to be associated with the overall population increase than other counties. The marginal probability (-0.01) of the initial urban population indicates that a higher percentage of the urban population is 1 percent more likely to be related to population increase than other counties. Among the changed variables, changed labor force population (with a marginal probability of 0.04) is positive and significant at the 5-percent level, suggesting that the increased labor force in a given county is 4 percent more likely to be associated with the increase in the overall population of the county than those counties that do not observe increase in labor force between 1970 and 2000. Changed college population is significant at the 5-percent level with a positive sign (0.04), suggesting that the counties with increased percentage of college graduates are 4 percent more likely to be correlated with the population growth of a county than those counties that do not gain college graduates.

Results of 1980-2000 Population Change Model

Table 8 shows the results of the binary logit model for 1980 and 2000. The Nagelkerke R^2 value is 50.2 percent, larger than 44.6 percent, which suggests that the 1980-2000 logit model is stronger than the 1970-2000 model in predicting the probability of the relationship between independent variables and increase in the population of a county. Among initial conditions, AA population, employed population, and travel time were significant at the 1-percent level, and labor force was significant at the 5-percent level. Among the changed conditions (1980-2000), change in urban population and change in PCI are significant at the 1-percent level, and change in retirees at the 5-percent level. Within initial conditions, the AA population and the labor force population have a negative and a positive coefficient of the correlation with the population increase, respectively. In other words, the counties with a higher percentage of AA population in 1980 are 1 percent less likely to be associated with the population increase than the counties with a lower percentage of AA population in 1980. In the other hand, counties with a higher percentage of the labor force population are 3 percent more

TABLE 8. RESULTS OF BINARY LOGIT MODEL (1980 AND 2000).

VARIABLES	β COEFF.	STD. ERR.	WALD STAT.	EXP(β)	MARGINAL PROB.
Initial Conditions					
African-American.	-0.05**	0.01	30.85	0.95	-0.01
Labor Force.	0.20*	0.09	5.16	1.22	0.03
Retiree.	0.06	0.08	0.44	1.06	0.03
High School.	-0.01	0.06	0.05	0.99	0.00
College.	-0.07	0.12	0.34	0.93	-0.01
Employed.	0.10**	0.03	15.23	1.11	0.02
Urban.	0.01	0.01	0.63	1.01	0.00
Travel Time.	0.44**	0.08	27.48	1.56	0.06
PCI.	0.00	0.00	1.91	1.00	0.00
Changed Conditions					
African-American.	-0.04	0.02	3.02	0.96	-0.01
Labor Force.	0.02	0.10	0.04	0.98	0.00
Retiree.	-0.33*	0.11	9.20	0.72	-0.02
High School.	-0.05	0.04	1.20	0.96	-0.01
College.	0.11	0.07	2.50	1.12	0.01
Employed.	-0.05	0.05	1.00	0.96	-0.06
Urban.	0.05**	0.01	23.58	1.05	0.00
Travel Time.	0.01	0.09	0.01	1.01	0.00
PCI.	0.04**	0.01	10.18	1.04	0.01
Constant.	-16.57	6.95	5.69	0.00	

NOTE: $^{*}p \leq .05$; $^{**}p \leq .01$

likely to be associated with the population increase than the counties with a lower percentage of the same population. Likewise, both the initial employed population and travel time have positive coefficients to population increase. The marginal probability (.06) of the average travel time to work in a county in 1980 suggests

that the counties that take longer time for the commuters to go to work are 6 percent more likely to be associated with the population increase than the other counties that take shorter commuting time to work. Among the changed conditions, the retiree population growth shows a marginal probability of -0.02, suggesting that counties with increased retiree population over the 20-year period had lower probability (2 percent) of population growth relative to other counties. Similarly, the counties with the changed urban population had only 0.1 percent marginal probability of the correlation with the population increase, suggesting that increasing urban population of a county is 0.1 percent more likely to be associated with population increase than other county that show decreasing urban population. Changed PCI has a positive coefficient. The marginal probability of this variable (0.01) suggests that increased average PCI of a county had 1 percent more likelihood of being correlated with population increase between 1980 and 2000 than other counties.

Results of 1990-2000 Population Change Model

Table 9 shows the results of the binary logit model for 1990-2000. The Nagelkerke R^2 is 42.6 percent, which demonstrates a moderate correlation between the dependent and independent variables. Initial conditions of AA population, employment, and changes in urban population variables are all significantly related to the increase in population between 1990 and 2000 at the 1-percent level. Initial urban population and changed retiree population are significant at the 5-percent level. Among the initial condition variables, the AA population shows a negative sign and its marginal probability (-0.01) suggests that the probability of the association between counties with a higher population of African-Americans and population increase in 1990-2000 is 1 percent lower than that in other counties. Contrariwise, the counties with a higher percentage of employed population in 1990 were 3 percent more likely to be associated with population increase, as suggested by the relevant marginal probability of 0.03. On the other hand, initial urban population had a negative estimated coefficient, with a marginal probability of -0.01. However, counties with an increase in urban population are 1 percent more likely to be correlated with an increase in population than other counties whose urban population did not increase during the 10-year period (1990-2000), as suggested by the marginal probability of 0.01. Also, within changed condition variables, the retiree variable is significant with a negative sign. The marginal probability value of -0.09 for change in the retiree population suggests that the counties with higher percentages of retiree population are 9 percent less likely to be correlated with an

increase in overall population between 1990 and 2000 in those counties than in the other counties.

TABLE 9. RESULTS OF BINARY LOGIT MODEL (1990 AND 2000).

VARIABLES	β COEFF.	STD. ERR.	WALD STAT.	EXP(β)	MARGINAL PROB.
Initial Conditions					
African-American.	-0.04**	0.01	15.98	0.96	-0.01
Labor Force.	0.10	0.09	1.14	1.10	0.02
Retiree.	-0.05	0.08	0.35	0.95	-0.01
High School.	0.03	0.07	0.26	1.04	0.01
College.	0.02	0.07	0.09	1.02	0.00
Employed.	0.16**	0.03	26.84	1.18	0.03
Urban.	-0.02*	0.01	9.74	0.98	-0.01
PCI.	0.00	0.00	0.00	1.00	0.00
Changed Conditions					
African-American.	-0.04	0.03	1.53	0.97	-0.01
Labor Force.	-0.22	0.14	2.35	0.81	-0.05
Retiree.	-0.41*	0.15	7.37	0.66	-0.09
High School.	0.01	0.04	0.11	1.01	0.00
College.	0.12	0.09	1.88	1.12	0.02
Employed.	0.00	0.06	0.00	1.00	0.00
Urban.	0.04*	0.01	14.93	1.04	0.01
PCI.	0.01	0.02	0.13	1.01	0.00
Constant	-11.72	7.16	2.68	0.00	

NOTE: *$p \leq .05$; **$p \leq .01$

CONCLUSIONS AND POLICY IMPLICATIONS

The objective of this study was to explore the dynamics of urban sprawl and rural rebound of population in the 10-state southeastern United States, in the 1970-

2000 period. Descriptive statistics showed that urban places are steadily increasing, which means that more people moved to urban areas during this study period.

This analysis employed cross-sectional data between 1970 and 2000 to examine whether population change is related to socioeconomic and other demographic variables. Three binary logistic models were specified: (1) between 1970 and 2000, (2) between 1980 and 2000, and (3) between 1990 and 2000. Model two (between 1980 and 2000) provided the best overall results (based on R^2 value), followed by model one (between 1970 and 2000) and model three (between 1990 and 2000), respectively.[2] Overall, African-American population, labor force and retiree population, college education, and employment are important variables that are highly correlated with the population increase, regarding out-migration, in all three models. The African-American and employed populations showed consistent results in each model, that is, they were all significant in all three models. People prefer living in areas where a quality education and job opportunities are available. Likewise, in-migration in rural counties has occurred more among retirees or older people who are not as economically productive (Albrecht 2010). This study provides important insights into the contribution of socio-demographic attributes of the study region for understanding rural rebound and urban sprawls. The results are consistent with the previous studies, suggesting broadly that availability of jobs and better education opportunities in urban areas are the major factors of rural out-migration, especially among the younger generation (Domina 2006).

The results of this study suggest the need for balancing rural-urban growth by establishing rural-urban business linkages. High emphasis on agricultural jobs and businesses, such as agro-based industries and the creation of other off-farm activities will assist in reducing rural-to-urban area migration of economically active populations. It is presented as one option that may be pursued to redress the rural-urban imbalance and thereby reduce rural poverty. Other policy measures include a decentralization of small goods production industries and processing centers linked with the nearest large towns and/or cities and expanding employment opportunities in rural places. For instance, core areas draw employees away from proximate rural communities. Urban planners, therefore, pay special attention to this aspect. Policies that assist to grow both an urban core and rural

[2]One reviewer expressed concern regarding possible effects of the shift in definition of "urban" in decennial 2000 and earlier censuses on the results of regression analysis. To address the reviewer's concern, we performed statistical tests for significance on the samples drawn from two census periods individually and compared those results with the results of the entire data. We have found no such significant effects due to change in definition of urban population.

corridors will also yield urban spread effect from the urban export sector to rural services, and simultaneously create jobs for urban population growth in rural service employment.

This study provided important insights on the relationship between population change and important socio-demographic factors for different time-periods. In addition, this study fills a void from past research that has not provided historical and temporal explanations of the patterns of rural-urban or urban-rural migration and economic growth in the southeastern United States. Policy connection in employment growth and the improvement in quality of life of rural areas will have long-term effects in bringing equilibrium in population change between rural and urban counties in the southeastern United States. Moreover, maintaining or increasing the quality of an economically active labor force and human capital in rural areas is a prime challenge for policymakers.

There are some limitations of this study. The models were not as strong as desired due to limitations in the availability of consistent data. Further research should be done with more appropriate variables using more historical and recent data (such as from 1950 to recent Census data) to examine and understand the trends of population change between urban and rural counties. Census 2010 data were not available during this study.

Additionally, more disaggregated analysis using sub-county level census tract or census block group data within metropolitan and micropolitan statistical areas could be examined, including variables such as commuting distance to work by employed residents; effects of communication technologies in jobs; impacts, location, and types of new jobs and industries; road networks; wage disparity; and other social and environmental indicators. The authors will continue to expand this study by including these dynamics to closely understand the social and economic integration of rural-urban metaphors using more disaggregated data.

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