Income Convergence and Growth in Alabama: Evidence from Sub-county Level Data

Authors

Buddhi Raj Gyawali,
Research Assistant Professor, Department of Agribusiness, P. O. Box 323, Alabama A &M University, Normal, AL 35762. Email: buddhi.gyawali@aamu.edu

Rory Fraser,
Professor, Forestry, Wildlife, and Ecology program, P.O. Box 1927, Alabama A &M University, Normal, AL 35762, Email: rory.fraser@aamu.edu

Ban Banerjee,
Assistant Professor, Department of Agribusiness, P.O. Box 323, Alabama A &M University, Normal, AL 35762, Email: ban.banerjee@aamu.edu

James Bukenya,
Associate Professor, Department of Agribusiness, P. O. Box 323, Alabama A &M University, Normal, AL 35762, Email: james.bukenya@aamu.edu

Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31-February 3, 2009

Income Convergence and Growth in Alabama: Evidence from Sub-county Level Data

ABSTRACT

1980 and 2000 Census Block Group (CBG) data were used to examine income convergence in all Alabama counties vis-à-vis Alabama's Black Belt and Northwest regions. Though all three models demonstrated conditional income convergence, CBGs with smaller initial populations, smaller changes in African-American or dependent age populations had higher income changes.

KEYWORDS:

African-Americans, Alabama, Black Belt, Census Block Groups, Income Convergence

INTRODUCTION

Income convergence is one of the major indicators of regional economic development (Solow 1956; Cass 1965; Koopmans 1965). Large differences in income are considered undesirable for balanced or equitable economic development (Sen 1992). Substantial research has been conducted to determine whether there is convergence or divergence in regional economies over time. These studies were designed to track the growth of local economies and assess their pace and progress in achieving national economic growth levels. Previous research suggests the existence of income convergence (Barro and Sala-i-Martin 1992) and in some cases, income divergence across the United States (Mankiw, Romer, and Weil 1992). Some of the empirical evidences (Barro and Sali-i-Martin 1995; Cole and Neumayer, 2003) contradict Neoclassical growth theorists' (Baumol 1986) prediction that poorer economies grow at a faster rate compared to the richer economies to reach the equilibrium levels. Variations in the results of these studies may be due to the differences in economic characteristics of regions since it has

been difficult to meet that "studied regions" maintain the same steady state, a fundamental condition for determining the existence of income convergence. Other sources of variations may have been differences in the spatial characteristics across regions and difficulties in capturing these interregional variations of the "studied regions". That is most of the "income convergence studies" thus far have been conducted at larger geographic scales such as county, region, state, or national levels. These studies did not address clustering of the communities based on similarities in physical geography and socio-economic characteristics. The concentration of primary resources, such as farmland and forests or agglomeration in the manufacturing sector, was inadequately addressed.

OBJECTIVES

This study explicitly examines income convergence at the Census Block Group (CBG) level in Alabama. The CBG is the lowest unit for which the U.S. Census Bureau makes its data available to the public. Three fundamental objectives were to: (1) examine income convergence in Alabama between 1980 and 2000, (2) identify predictors of income growth over the period 1980-2000, and (3) Compare and contrast income growth and its predictors at the sub-county level between entire CBGs in Alabama, CBGs in the West-Central Black Belt region (African-American-dominant counties) and CBGs in Northwest Region of Alabama (white-dominant counties).

The historical events in Alabama have produced differing impacts and regional variations across the state. There are significant contrasts between Black Belt region and Northwest region in demographics such as race, population density, education, and industrial firms and jobs and growing urban structures. This study is aimed at eliciting the role of these variations in income

growth using the data available at the sub-county level, which is the first known effort in the southern United States.

The rest of the paper is organized into six sections. Section two provides a summary of the literature in income convergence. Section three provides important details of the study area and the data used in the study. Section four is an explanation of empirical model of income convergence. Section five presents the results of a regression model. Lastly, section six provides the conclusions.

LITERATURE REVIEW

Income convergence is the narrowing of differences in incomes across a region or country over time (Barro and Sala-i-Martin 1992; Mankiw et al. 1992). Empirical studies have identified examples of income convergence (Coelen 1978; Barro and Sala-i-Martin 1991; Crown and Wheat 1995). However, others (Chatterji 1992; Quah 1996; Pritchett 1996) contend that modern economic growth display significant divergence in per capita incomes between rich and poor countries, an increasing gap which is incessantly widening. This empirical global evidence contradicts Neoclassical growth theorists' (Baumol 1986; Barro and Sali-i-Martin 1995) predictions of "absolute or beta (β) convergence" (Cole and Neumayer 2003). That is poorer economies grow at a faster rate as compared to the richer economies if they have the same steady state per capita income growth path. Absolute convergence is most often not possible because differences in technology, availability of initial capital, resource potentials, and other human and cultural factors not allow for the identical and balanced growth paths across regions; a pre-condition for absolute convergence (Sala-i-Martin 1996). Also, structural characteristics of regional economies including differences in labor force structure and public policies create

different steady states along the growth path of sub-regions. In such cases, conditional convergence prevails (Cole and Neumayer 2003). Conditional convergence occurs when poor economies grow faster because differences across the region are controlled (Sala-i-Martin 1996).

Numerous country or regional studies have reported evidence of income convergence in the U.S. (Evans and Karras 1996; Austin and Schmidt 1998; Tsionas 2000; Latzko 2002; Janikas and Rey 2005; Higgins, Levy, and Young 2006). Barro and Sala-i-Martin (1991, 1992, and 1995) have conducted many studies to explain convergence of per capita income across US states and regions and across the world. These studies reported the prevalence of income convergence in the US during most of 1889 to 1988 period. Two decades, the 1920's and 1980's were the exception. In those decades, income divergence was recorded. Convulsions in agriculture in 1920s and the collapse of oil prices in the 1980s were the reasons identified for income divergence. Similarly, in a comparative study between the USA and Japan, Barro and Sala-i-Martin (1995) estimated convergence rate of 1.9% for the 48 contiguous US states, which was lower than the 2.79% rate for Japanese prefectures. In another study of 110 countries' economic growth, Sala-i-Martin (1996) found a 2% annual conditional convergence rate when secondary school enrollment, saving rate, and political variables were controlled. Kim (2005) found conditional convergence rate of 8% a year in 13 regions of Korea based on per capita income changes over the period 1985-2002. This study reported a significant positive effect of investment rate in physical capitals and a significant negative effect of population growth on the growth rate of per capita income. The study did not find a significant relationship between growth in per capita income and the rate of human capital growth. In contrast, Drennan, Tobier and Lewis (1996) found divergence in the median family income in the 1980s in the 51 largest US cities for all households versus black households. Their results suggested that cities with

larger service sectors had much better growth rates than cities more specialized in manufacturing.

The results of these studies, particularly Evans and Karras (1996) and Higgins et al. (2006) have come into question because of model specification problems. These studies, which were mostly conducted at larger geographical areas such as counties, regions, state or national level, assumed each observation unit was independent. Researchers such as Rey and Montouri (1999), Lim (2003), Janikas and Rey (2005), Shelnutt and Yao (2005), and Coughlin et al. (2006) contend that the unit of observation such as countries, states or regions are politically defined boundaries rather than economic boundaries. Labor movement, commuting patterns, trade flows, presence of industries, access to the highways, public policies and resources allocations can link economies of these areas together despite their political jurisdictions. Under-representing the potential interactions between such economic units (or units of observations) in an empirical model may lead to incorrect inferences regarding the magnitude and significance of predicting variables (Anselin 1988; Haining 1990; Janikas and Rey 2005).

Janikas and Rey (2005) contend that clustering across US states masks important internal socio-economic dynamics. Therefore, the effects of the clustering needs to be detected to understand what occur within individual state economies. The use of disaggregated Census Block Group level data may address such data aggregation issues.

Previous Studies in South

Studies in the southern United States suggest that these states differ from northern regions in population dynamics, industrial structure, and job growth. The persistence of unemployment, lower wages, and low mobility of workers in the South may be due to the

inability of these regions to absorb specific shocks, be they from the demand or supply side (McLaughlin and Stokes 2002; Albrecht et al. 2005). The adjustment process in economy may also take longer period in south due to differences in unemployment, human capital, and income growth which will slow down the equilibrium process of economy across the region. Such phenomena can be observed in Alabama if we closely look disparities that are occurring across different geographic regions.

In general, the characteristics of the U.S states suggest a set of economies in which there exists nearly complete free trade and mobility of factors, and nearly identical forms of government. Due to such advantage, many of the conditions for income convergence prevail strongly. In support to this argument, Barro and Sala-i-Martin (1991, 1992) found support for conditional convergence across both regions of Western Europe and U.S. States. The studies found that Northeast, Midwest, Great Lakes, and Far West regions typically have per-capita incomes above the national average, while the Plains, Southeast, Southwest, and Rocky Mountains regions typically lie below the national average.

Crown and Wheat (1995) conducted a study on state per capita income convergence using 1950-1987 data. The study found that South is catching up the income growth of Northern States. The authors found that income convergence in the South resulted from the South's overcoming of its legacy of slavery, agricultural dependence, high Black population percentages, poor education, and low wage rates. High South-to-North migration contributed to raise incomes in the south. The study found that growth in manufacturing and transportation caused decline in the relative income in the Western United States.

Crown and Wheat (1995) reports that in 1950, all ten southern states (West Virginia, North Carolina, South Carolina, Georgia, Kentucky, Tennessee, Alabama, Mississippi, Arkansas,

and Louisiana) were more than 25 percent below the national average income. However, after 1950, the income gap between southern and non-southern states closed rapidly. The south's income growth increased by 161%. The authors also found that State income inequality increased between 1978 and 1988 because of the regional income boom in the Northeast, the farm crisis of the 1980s, and the decline in energy prices in the post 1980 economic depression.

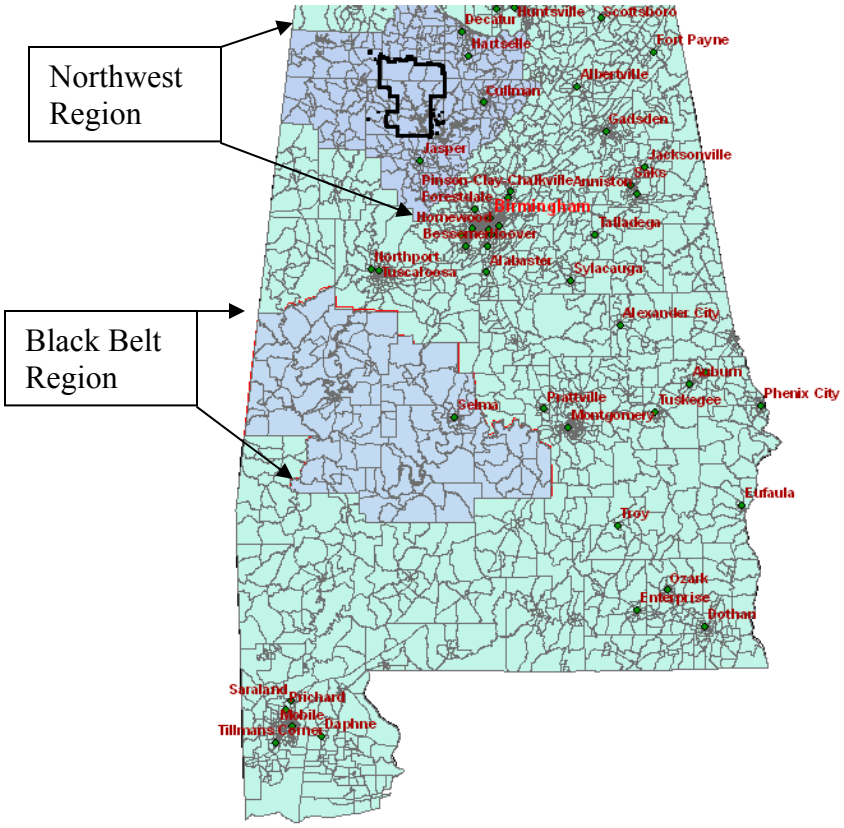
STUDY AREA

The majority of the studies on US income convergence are based on the States or multi-state aggregate data, with few examinations in metropolitan areas and counties (Hammond 2005). This study employs data available at the sub-county level. The area chosen for this study consists of entire sixty-seven counties of the State of Alabama. The study analyzes income convergence and growth separately for Black Belt and Northwest Region and compares the results with entire Alabama. Predominant African American counties were selected from the west-central Region of Alabama (hereafter Black Belt Counties) and predominant white counties were selected from Northwest Region of Alabama (hereafter Bankhead Region). These regions were selected because they represent the largest contiguous group of Black-dominant and white-dominant counties in Alabama and indicate high contrast in demographic, urban structure and industrial jobs.

State of Alabama

State of Alabama consists of 67 counties bordering to Tennessee, Georgia, and Florida in North, Northeast to Southeast, Gulf of Mexico in the South and Mississippi in the Southwest to North West. The total population (2006 estimates) is 4,599,030 with the population density 88 persons

per square mile. The change in population between 2000 and July 2006 was an increase of 3.4%. The estimated black and white population percents are 71.2% and 26.3%, respectively. The homeownership rate in 2000 was 72.5%. The median household income in 2004 was $37,062 and personal income in 2005 was 29,623. The percentage of persons below poverty level was 16.1% (USA 12.7%). The unemployment rate in 2006 was 3.6% (USA 4.6%). Average earning per job in 2005 was $39, 291 (USA 45,817). The change in private non-farm employment between 2000 and 2005 was 0.9%.



Study Area showing Alabama State, Northwest Region and Black Belt Region

Role of Industries in Alabama

Alabama is one of the top five states in the United States for favorable business climate. Also, Alabama is considered number one in the nation on corporate diversity. In Alabama, paper, chemicals, rubber and plastics, apparel and textiles, and automobile manufacturing industries are major sectors for jobs and for the state's revenue. Birmingham is considered for major manufacture of coal, iron and steel. The state ranks high in the production of poultry, soybeans, milk, vegetables, livestock, wheat, cattle, cotton, peanuts, fruits, corn and hog.

Alabama's industrial boom began in the 1870s with the exploitation of the coal and iron fields in the north. Birmingham became a leading industrial city in the South, producing iron more cheaply than its American and English competitors. Development of ports and power plants along the Tennessee River was the primary stimulus to the expansion of manufacturing sector.

By the 1970s, the older industries were clearly in decline, but Birmingham received a boost in 1984 when U.S. steel announced it would spend $1.3 billion to make its Fairfield plant the newest fully integrated steel mill in the nation. In 1997, Mercedes Benz began manufacturing its sport utility vehicle at a new facility in Vance. Other automobile plants, Hyundai and KIA have established their auto plants in Southern Alabama. Two major auto-manufacturing plants (Mercedes-Benz and Hyundai) now generate 10% of the state's manufacturing gross-state product. In 2003, the auto industry in Alabama accounted for 96,200 jobs, of which two-thirds are in southern Alabama (Auto Alliance 2003).

The principle employers among industry groups are food and textile mill products, apparel, primary metal industries, industrial machinery and equipment, electric equipment, and transportation equipment. The electrical machinery and computer and transportation equipment

in Alabama are typically exported to Canada, Mexico and Germany. The value of manufacturing shipments in 1997 equaled $69.7 billion, with a 31.9% growth from 1992. Alabama was found directly in the middle of states ranked by growth in manufacturing. Mineral industries grew at rate of 65.4% from 1992 to 1997, to $12.6 billion of business done during 1997.

Earnings of persons employed in Alabama increased from $63.8 billion in 1997 to $66.9 billion in 1998, an increase of 4.9%. The largest industries in 1998 were services, 23.2% of earnings; state and local government, 12.5%, and durable goods manufacturing, 12.1%. Of the industries that accounted for at least 5% of earnings in 1998, the slowest growing from 1997 to 1998 was transportation and public utilities (6.6% of earnings in 1998), which increased 7.7% (Alabama Industry 2008).

Role of Forest-based Industries

Alabama is blessed with the presence of natural forests, rivers and creeks and laborious people that all have contributed growth of forest industry within the State. As a result, forest product industry is the number one manufacturing industry in Alabama today. The region is one of the largest timber producing and exporting state in the U.S. Timber is the dominant crop harvested in 34 counties with a value at the first delivery point at over $1 billion. In total, Nine billion dollars worth of forest products are produced in Alabama each year.

Alabama contains the nation's second largest area (21.6 million acres) of commercial forest. There are 167 primary forest manufacturing facilities in the State; of these, 98 are sawmills, 19 are plywood or veneer mills, and 14 are pulp and paper mills (Alabama Forestry Commission 2007). Much of this forest is located in Alabama's west-central region which was

expected to grow faster due to higher paying industrial jobs, capital accumulations, and human capital development (Joshi et al. 2000).

Forest industries in Alabama play enormous role in economy. Alabama's forests and forest based industries contribute over $5 billion to the State's annual economy. It generates employment for 66,800 people. They have an annual payroll of over $1.7 billion. Despite one of the largest timber producing and automobile industry state in the US, the state is ranked the third poorest state of the Nation.

Northwest Region of Alabama

The northwest region of Alabama includes seven predominantly white counties (>50% of white population). The William B. Bankhead National Forest (BNF) is located in this region. The BNF was once a part of the diverse mixed hardwood forest, very common to the Cumberland Plateau, which have provided economic opportunities and raw material to the forest-based industries in the region. The Courtland paper mills in Laurence county employs approximately 400-500 people. Likewise, other industrial plants such as General Electric Company and Brownsferry nuclear plant in Morgan County provide jobs for 2000 people. A trailer factory in Winston county is another employer for local people. Walker, Morgan and Laurence counties have industrial parks. In Winston county most of the landowners are forest landowners and logging job has been increased considerably.

Black Belt Region

Southwest Region constitutes of eight contiguous pre-dominant African American counties in the west central region of Alabama (which are also called Black Belt Counties).

These counties are economically and racially segregated differentiated by disparities in income, population distribution, resource allocation, and human capital development (Schelhas et al. 2003). The Black Belt counties of west-central Alabama are of special interest because of the majority presence (67%) of minority populations (26% in Alabama) (African-Americans). One can assume that after the significant civil rights and welfare reforms of the 1960s in this eight county area, African-Americans wield their highest level of political and administrative influence in the state and, therefore, individually or collectively have a greater likelihood of achieving equal or higher levels of economic growth in the region.

EMPIRICAL MODEL

We follow the empirical framework of Mankew et al. (1992), Sala-i-Martin (1996) and Rey and Montouri (1999) to explore income convergence and income growth factors in Alabama. The following equation was used to test for the conditional income convergence:

$$\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta_0 (\ln y_{i,t-1}) + \beta_i X_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

Where $\ln y_{i,t} - \ln y_{i,t-1}$ is a natural logarithm of a CBG *i*'s per capita income growth for a time period between *t* and *t-1*, $\ln y_{i,t-1}$ is the natural logarithm of region *i*'s average per capita income in the initial year. $X_{i,t-1}$ is a vector of growth in explanatory variables. The conditioning factors are initial and changed conditions of population, race, education, age structure, and firms and jobs growth that control per capita income growth and β_i is a vector of X_i parameters. $\varepsilon_{i,t}$ is an error term.

The existence of the conditional convergence or divergence for per capita income growth is determined by the sign and magnitude of β_0. A negative estimate for β supports the conditional income convergence suggesting that the growth rates in per capita income over the period are negatively related with initial per capita income levels. The empirical model of neoclassical growth model (such as Solow 1956) is that once the determinants of steady-state per-capita income have been controlled for, economies show convergence. At a point in time there exists a negative relationship between initial log per-capita income and rates of growth. Given its dependence upon the factors determining the steady state, Mankiw, Barro and Sala-i-Martin, refer to this form of convergence as conditional convergence (Loewy and Papell 1996).

Steady state differences on educational attainment, industrial mix, and other structural factors are common in the southern United States. One of the causes for disparity between rural and urban growth has been attributed to the industrial composition often found in rural areas. The specialization of rural areas in farming, mining, and in some cases manufacturing, in contrast to the urban places has been discussed in previous studies. Generally in south, agriculture and natural resource sectors have been hit by competitive pressures and unfavorable commodity price swings since the 1970s. Manufacturing sector has been affected most by competitive pressure during the period, both from domestic and from international sources. The result has been declining employment and income levels related to these industries (Hammond 2005)

Unit of Analysis: Census Block Groups

The empirical model is based on the cross-sectional regression analysis. The cases are 3,327 CBGs (for entire 67-states Alabama), 234 CBGs (for Northwest Region) and 161 CBGs (for Black Belt Region). The dependent variables in all models were the natural logs of the ratios

of per capita income in 2000 to real (in 2000 dollar value) per capita income in 1980 for each CBG. The CBG is the lowest unit for which the U.S. Census Bureau makes its data available to the public (Geolytics 2004). Typically, CBGs range between 600 and 3,000 people, with an optimum size of 1,500 people (U.S. Census Bureau 2007). Compared to larger geographical units, CBGs tend to be relatively homogeneous internally with respect to demographics, economic status, and living conditions. The geographic boundaries of CBGs may change from one census to another. Data available for these units are not suitable for comparative analysis over time unless they are normalized to maintain the same boundaries in each census. Recently, Geolytics Inc. made available the 1980 census data normalized (weighted) to the 2000 boundaries and these data have been widely used for comparative study (Crandall and Weber 2004)[1].

[1] For details information on normalization process, please visit http://www.geolytics.com/USCensus,1980_in_2000_Boundaries,Products.asp

Table 1. Description of the Variables used and the Expected Relationship between Dependent, Independent and Control Variables for 1980 and 1980-2000

Variables	Description	Variable Type	Expected Relationship
Per Capita Income (PCI) Growth	Natural logs of the ratios of PCI of each CBG in 2000 to real (in 2000 $$ value) PCI in 1980 for each CBG.	Dependent	
PCI in 1980	Log value of the PCI in 1980 in 2000 real value	Independent	-
Population Density	Number of persons per acre	Control	+
African-Americans	% of AA population in 1980	Control	-
Dependent population	% of 15 or younger age population in 1980	Control	-
College education	% of 25 years or older population with the bachelor degree in 1980	Control	+
Agricultural Jobs%	% of a CBG's work age population in agricultural jobs in 1980	Control	+
Construction Jobs%	% of a CBG's work age population in agricultural jobs in 1980	Control	+
Manufacturing jobs (EMP)	% of a CBG's work age population in manufacturing jobs in 1980	Control	+
Wholesale Jobs%	% of county's firms in the whole sale sector in 1980		
Retail Jobs%	% of a CBG's work age population in retail sector in 1980	Control	+
Financial Jobs%	% of a CBG's work age population in financial sector in 1980	Control	+
Transportation Jobs%	% of a CBG's work age population in transportation sector in 1980	Control	+
Service sector jobs%	% of a CBG's work age population in service jobs in 1980	Control	+
Change 1980-2000			
Change in population density	Difference in population density, 1980-2000	Control	+
Change in AA population	Difference in % of AA population, 1980-2000	Control	-
Change in dep. population	Difference in % of young population, 1980-2000	Control	-
Change in college education	Difference in the % of bachelor degree holder population, 1980-2000	Control	+
Change in Agricultural Jobs	Difference in the % of agricultural jobs, 1980-2000	Control	+
Change in Construction Jobs%	Difference in the % of construction jobs, 1980-2000	Control	+
Change in Manufacture Jobs%	Difference in the % of manufacture jobs, 1980-2000	Control	+
Change in Wholesale jobs%	Difference in the % of wholesale jobs, 1980-2000	Control	+
Change in Retail Jobs%	Difference in the % of retail jobs, 1980-2000	Control	+
Change in Transp. Jobs%	Difference in the % of transportation jobs, 1980-2000	Control	+
Change in Fin. Jobs%	Difference in the % of financial jobs, 1980-2000	Control	+
Change in Service Jobs%	Difference in the % of service jobs, 1980-2000	Control	+

RESULTS

Descriptive Statistics

Table 2 provides the descriptive statistics of the major variables. Comparison of the descriptive statistics for Alabama and the two regions provide some indications of income convergence in the state. The average Per Capita Income (PCI) for both the Northwest and Black Belt CBGs were lower than the average PCI for the state's CBGs in both 1980 and 2000. However, the average (positive) change in both regions were higher than the state's, with the Black Belt showing the highest (33%) change after starting with the lowest of the three PCIs. These positive income changes are reflected in the reduction of poverty levels, with the highest reduction (-14%) occurring in the Black Belt. The higher rate of income growth in the Black Belt seems to have come in response to the highest increase (91%) in the average percent of high school educated population and a higher level of college educated population. This change also occurred, despite a reduction (-8%) in average employment in the Black Belt which had the lowest employment rate and lowest increases in college educated population. Some of the increases in PCI in the state and the two regions must have come from the reduction in the average percentages of dependent age populations in the CBGs.

Table 2. Descriptive statistics of the Major variables for 1980, 2000, and 1980-2000

Variables	Alabama (3227 CBGs	North west (234 CBGs)	Black Belt (161 CBGs)	Alabama	North-west	Black Belt	Alabama	North-west	Black Belt
	1980	2000	1980	2000	2000	2000	%Change	% Change	% Change
Population	1,171	1,038	1,034	1,336	1,155	928	14	11	-10
White%	74	95	38	67	91	34	-10	-4	-12
Black%	25	5	61	31	5	65	21	3	6
Young%	25	26	29	22	21	25	-13	-17	-16
High School%	20	20	18	31	34	34	52	69	91
College Edu%	8	4	6	16	9	12	117	139	89
Employment%	34	33	29	53	53	43	56	63	45
Per Capita Income	13,283	12,191	9,835	16,994	15,775	13,094	28	29	33
Poverty %	19	18	36	18	16	31	-5	-12	-14
No of Jobs	455	384	327	577	489	300	27	27	-8
Agriculture%	4	10	6	2	4	5	-46	-58	-26
Construction%	7	7	7	8	8	7	9	22	1
Manufacturing%	27	34	29	20	26	24	-28	-23	-16
Whole Sale%	4	4	4	3	3	3	-14	-9	-31
Retail%	15	13	12	12	13	11	-18	3	-7
Transportation%	7	7	6	7	8	6	7	16	12
Finance%	4	3	3	5	4	3	16	30	-2
Service%	32	23	33	43	33	41	35	44	23

The numbers in the cells are averages for the CBGs and weighted averages (e.g. by population)
N = 3227 CBGs (Alabama), 234 CBGs (Northwest), and 161 CBGs (Black Belt)

Results of Regression Analysis

The results of the Ordinary Least Squares (OLS) estimation of the conditional convergence for Alabama, Northwest and Black Belt regions as specified in equation 1 are presented in Table 3. The overall fit of the model is highly significant for all three study area (Alabama: F= 195.23, Northwest: F = 19.77, Black Belt: F = 34.41) at the P =<.001 level. The R^2 values are: 0.48 for Alabama, 0.42 for Northwest, and 0.63 for Black Belt (Table 3). The estimated β coefficients of the initial per capita income level in all three models are negative and highly significant, confirming the proposition of the conditional income convergence over the 20

years period as theorized by neoclassical growth model. The annual rate of income convergence over the 20 years period is 1.94% for Alabama, 3.57% for Northwest, and 3.99% for Black Belt[2].

Conditional income convergence is evident in all the three models. Demographic factors such as population, race, age, and education, as well as employment factors conditioned income convergence in the three areas. Four factors are consistent across the three regions: the initial population levels, and the changes in racial composition, age structure, and educational levels. CBGs with smaller populations in 1980 were more likely to have positive income change, while CBGs with smaller changes in the African-American and dependent age populations were more likely to have higher income changes. CBGs with greater increases in college educated populations were also more likely to grow at incomes at a higher rate.

Other factors were important in each of the models, but not necessarily in the same way. In both the Black Belt and the Northwest areas for example, the average percentage college educated populations in 1980 were important. However, in the case of the Northwest communities with higher education levels in 1980 had higher income growths, whereas, the opposite was true for the Black Belt. That is, the lower average education levels in a Black Belt CBG in 1980 the greater were the likelihood it would experience income growth. Smaller changes in population in Alabama's CBGs and lower African-American population levels in Black Belt CBGs were further associated with positive income growth.

Employment was important in explaining income growth in all three areas -Alabama had 10, Northwest had three and the Black Belt had one- employment sectors which contributed in a significant way to their income growth. In the Black Belt, CBGs with fewer manufacturing jobs in the 1980 did better. In the Northwest Region, the wholesale trade and transportation were

[2] The convergence rate is calculated using $\theta = -\ln(\beta + 1)/t$, where t is the number of years in the time period (Lim 2003).

significant. CBGs with higher wholesale jobs in 1980 and larger changes in transportation jobs did well, whereas with less changes in or declining manufacturing jobs did not do as well. Not surprisingly, seven of the eight sectors were important in Alabama CBGs. Only the ubiquitous retail trades sector was not significant.

Construction, finance and transportation were the sectors which explained much of the positive impact of employment on income growth in the state. CBG with more jobs in these sectors in 1980 and with the greatest growth in jobs in these sectors were more likely to have positive income growth. Greater changes in the Wholesale and Manufacturing sectors were also positively correlated with income growth. On the other hand, CBGs more dependent on agriculture in 1980 and with higher increases in service sector jobs were less likely to experience higher income growth.

Table 3: Results of the Regression Analysis to predict Income Convergence and Growth between 1980 and 2000 in the CBGs of entire Alabama, Northwest Region and Black Belt Regions of Alabama

Variables	Alabama		Northwest		Black Belt	
	β	t-value	β	t-value	β	t-value
(Constant)	3.13	17.80	8.94	5.73	7.04	5.27
PCI in 1980	-0.32***	-16.95	-0.51***	-5.68	-0.55***	-4.72
Convergence rate	**1.94%**		**3.57%**		**3.99%**	
Population Density	-0.16***	-7.61	-0.24***	-4.12	-0.16***	-2.91
African-Americans					-0.43***	-4.21
Dependent population						
College education			0.25***	2.87	-0.22***	-2.77
Agricultural Jobs%	-0.03*	-1.68				
Construction Jobs%	0.04***	2.80				
Manufacturing jobs					-0.14*	-2.37
Wholesale Jobs%			0.12**	2.20		
Retail Jobs%						
Financial Jobs%	0.04***	2.03				
Transportation Jobs%	0.03**	1.97				
Service sector jobs%	-0.09***	-4.75				
Change 1980-2000						
Change in population density (ΔPOPDEN)	-0.04***	-2.15				
Change in AA population (ΔAA)	-0.21***	-13.89	-0.17***	-3.31	-0.37***	-6.35
Change in dependent population (ΔDEP)	-0.18***	-13.26	-0.14***	-2.70	-0.16***	-2.93
Change in college education (ΔEDUC)	0.51***	31.33	0.34***	6.27	0.22***	3.74
Change in Agricultural Jobs						
Change in Construction Jobs%	0.04***	3.01				
Change in Manufacture Jobs%	0.06***	3.90	-0.20***	-3.69		
Change in Wholesale jobs%	0.04***	3.06				
Change in Retail Jobs%						
Change in Transportation Jobs%	0.09***	6.01	0.10*	1.83		
Change in Financial Jobs%	0.08***	5.74				
Change in Service Jobs%						
R Square			0.42		0.63	
F value (DF)	195.23 (16,3307)		19.77 (9, 224)		34.41 (8, 152)	

Only significant variables are reported in the Table. *** <=1%, ** =<5%, and * =< 10% significance level.

CONCLUSION

There is a strong evidence of income convergence in Alabama including Northwest and Black Belt regions between 1980 and 2000. Over this twenty years period, per capita incomes of poorer communities in these regions increased at higher rates than that of wealthier communities. Empirical model estimates suggest economies of the poorer CBGs are catching up with the wealthier CBGs at the annual rate of 1.94% in Alabama, 3.57% in Northwest, and 3.99% in the Black Belt Region. The Black Belt communities are catching up faster compared to other regions, which is consistent with the neoclassical growth theory. Good as these rates are, they are still lower than rates estimated in other studies across the United States (Barro and Sala-i-Martin 1992; Lim 2003; Higgins et al. 2006). This means income convergence rates have some way to go if this region's income were to approach national levels.

The consistency in the correlation between changes in incomes and race and education in all regions is compelling evidence. The inverse relationship between growth in African American population and growth in per capita income suggests that incomes are grown at higher rate in the CBGs where African-Americans were not the majority population in 1980. This finding is consistent with anecdotal evidence that predominantly white communities benefited more than other communities from the increased income earning opportunities in the region over the 20 year period.

Educational attainment made significant contribution to income growth in Alabama over the 20 years period. Increasing levels of college education in the population have improved the local labor force and increased their earning potential. On the other hand, employment growth did not significantly influence income growth evenly across the regions. A finding more

consistent with observation that many of the college educated population are either retired, self-employed, or commute to work.

This paper has shown the importance of using less-aggregated data at a finer geographic scale when examining regional economic growth. The results also provide evidence that income convergence over the past twenty years period has provided more benefits to predominantly white population, who are a minority in the region. It can be argued that inferences based on the broad income growth models estimated at larger geographic scale may have provided misleading message in the past. This is very evident in both Alabama's Black Belt and northwest regions where population is geographically segregated by race and there is uneven distribution of human capitals and employment opportunities. This study's approach of examining economic growth at a finer geographic scale while considering conditional income convergence can provide more dependable results and more realistic assessment of income growth. Regional growth models can be built on aggregation of lower-level, such as the CBG level models. Such studies can better help policy makers understand the importance of internal and geographic dynamics of rural communities. An understanding based on underlying regional economic growth patterns can translate into more effective economic development policies and plans.

REFERENCES

Alabama Forestry Commission. 2008. Location of Primary Forest Industry Manufacturers. http://www.forestry.state.al.us/publication/PDFs/Alabama_Primary_Forest_Industry-Poster07.pdf

Alabama Industry. 2008. City data. www.city-data.com/states/Alabama-Industry.html, accessed on June 13, 2008.

Albrecht D. E. and C. M. Albrecht, and E. Murguia, 2005. "Minority Concentration, Disadvantage, and Inequality in the Nonmetropolitan United States," *The Sociological Quarterly* 46, 503-523.

Anselin, L., 1988. *Spatial Econometrics: Methods and Models*. Kluwer Academic Publishers: Boston, MA.

Anselin, L., 2003. Geoda 0.9.5-I5. *User's Guide*. Department of Agricultural and Consumer Economics, University of Illinois: Urbana, IL.

Austin, J. and Schmidt, J. 1998. Convergence amid divergence in a region. *Growth and Change* 9 (1): 67-89.

Auto Aliance. 2008. Annual Report. http://www.autoalliance.org accessed on June 5, 2008.

Barro, R. and X. X. Sala-i-Martin. 1995. *Economic Growth*, McGraw-Hill, Cambridge, MA.

Barro, R. J. and X. X. Sala-i-Martin, 1991. "Convergence across States and Regions," *Brookings Papers on Economic Activity* 1, 107-182.

Barro, R. J. and X. X. Sala-i-Martin. 1992. Convergence. *Journal of Political Economy* 100 (21): 223-251.

Baumol, W. J., 1986. "Productivity Growth, Convergence and Welfare: What the Long Run Data Show," *American Economic Review* 76, 1072-85.

Cass, D. 1965. Optimum growth in an aggregative model of capital accumulation. *Review of Economic Studies* 32 (91): 233-240.

Chatterji, M. 1992. Convergence clubs and endogenous growth. *Oxford Review of Economic Policy* 8: 57-69.

Coelen, S. P. 1978. Regional convergence/divergence again. *Journal of Regional Science* 18 (3): 447-457.

Cole, M. A. and E. Neumayer. 2003. The pitfalls of convergence analysis: is the income gap really widening? *Applied Economics Letters* 10: 355-357.

Coughlin, C. C., T. A. Garrett, and R. H. Murillo. 2006. Spatial dependence in models of state fiscal policy convergence. *Working paper 2006-001B*. St. Louis: Federal Reserve Bank of St. Louis.

Crandall, M. S. and B. A. Weber, 2004. "Local Social and Economic Conditions, Spatial Concentrations of Poverty and Poverty Dynamics," *Amer. J. Agr. Econ*. 86(5), 1276-1281.

Crown, W. H. and L. E. Wheat, 1995. "State Per Capita Income Convergence Since 1950 Sharing Cropping's Demise and Other Influences," *Journal of Regional Science* 35 (4), 527-552.

Drennan, M. P., E. Tobier, and J. Lewis, 1996. "The Interruption of Income Convergence and Income Growth in Large Cities in the 1980s," *Urban Studies* 33 (1), 63-81.

Evans, P. and G. Karras. 1996. Do economies converge? evidence from a panel of U.S. States. *Review of Economics and Statistics* 78 93) : 384-388.

Geolytics, 2007. Available at http://www.geolytics.com/USCensus,1980_in_2000_Boundaries_Products.asp. Accessed May 2007.

Geolytics, Inc., 2004b. U*.S. Census DVD Time Series Normalized Research Package Data*. Geolytics, Inc., East Brunswick, NJ.

Haining, R. P. 1990. *Spatial data analysis in the social and environmental sciences*. Cambridge, UK: Cambridge University Press.

Hammond, G. W., 2006. "A Time Series Analysys of U.S. Metropolitan and Non-metropolitan Income Divergence,". *Ann Reg Sci*. 40, 81-94.

Higgins, M. J., D. Levy, and A. Young. 2006. Growth and convergence across the U.S.: evidence from county-level data. *Review of Economics and Statistics* 88, forthcoming.

Janikas, M. V. and S. J. Rey, 2005. "Spatial Clustering, Inequality and Income Convergence," *Region at Development* 21, 45-64.

Joshi, M. L., J. Bliss, C. Bailey, L. Teeter, and K. Ward, 2000. "Investing in Industry, Under-Investing in Human Capital: Forest-Based Rural Development in Alabama," *Society And Natural Resources* 13, 291-319.

Kim, S., 1998. "Economic Integration and Convergence: U.S. Regions, 1840-1987," *The Journal of Economic History* 58 (3), 659-683.

Koopmans, T. C. 1965. On the concept of optimal economic growth. In *The econometric approach to development planning.* Amsterdam.

Latzko, D. A., 2002. "Convergence of Income across Pennsylvania Counties," *Eastern Economic Journal* 28 (4), 499-508.

Lim, U., 2003. "A Spatial Analysis of Regional Income Convergence," *Planning Forum* 9, 66-80.

Loewy, M. B. and D. H. Papell, 1996. "Are U. S. Regional Incomes Converging? Some Further Evidence," *Journal of Monetary Economics* 38, 587-598.

Mankiw N. Gregory, D. Romer, and D. N. Weil., 1992. A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics. May: 407-437.

McLaughlin, D. K. and C. S. Stokes, 2002. "Income Inequality and Mortality in US Counties: Does Minority Racial Concentration Matter?," *American Journal of Public Health* 92 (1), 99-104.

Pritchett, L. 1996. Forget Convergence: Divergence Past, Present, and Future. Finance and Development 33, 50-43.

Quah, D. 1996. Regional convergence clusters across Europe. *European Economic Review* 40: 951-958.

Rey, S. J. and B. Montouri, 1999. "US Regional Income Convergence: A Spatial Econometric Perspective," *Regional Studies* 33 (2): 143-156.

Sala-i-Martin, X. X., 1996. "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence," *European Economic Review* 40 (6), 1325-1352.

Schelhas, J., R. Zabawa, and J. Molnar, 2003. "New Opportunities for Social Research on Forest Landowners in the South," *Southern Rural Sociology* 19 (2), 60-69.

Sen, A. 1992. *Inequality reexamined*. New York: Russell Sage Foundation.

Shelnutt, J. P., and V. W. Yao. 2005. A spatial analysis of income inequality in Arkansas at the county level: Evidence from tax and commuting data. *Federal Reserve Bank of St. Louis Regional economic Development* 1 (1): 52-65.

Solow, R. M., 1956. "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* 70, 65-94.

Tsionas, E. G. 2000. Regional growth and convergence: evidence from the United States. *Regional Studies* 34 (3) : 231-238.

U.S. Census Bureau, 2007. Available at: http://www.census.gov/geo/www/GARM/Ch11GARM.pdf, June 2007.