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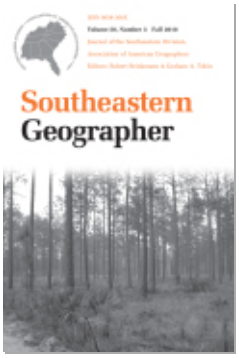

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Where is the South? Using Beta Convergence to Define a Fuzzy Region

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The American South is a region with a strong regional identity. This identity is frequently examined through cultural terms, but has also been examined in relation to its economic changes post-WWII. In that time, the South has seen a rapid rate of growth in relation to the historic poverty of the region. Using that growth as a starting point, this paper couches that growth in Convergence Theory as a new way of defining the South. Global and Local Moran's I tests are run for BEA Economic Area Per Capita Personal income for 1970 and 2004 to identify the local clusters of PCPI associated with a converging region over time. Those clusters are then used to define a "functional" economic South.

El Sur de los EE.UU. es una región con una fuerte identidad regional. Esta identidad es frecuentemente examinada a través de términos culturales, pero también ha sido examinada en relación a los cambios económicos experimentados después de la Segunda Guerra Mundial. En ese transcurso de tiempo, el Sur ha experimentado un rápido ritmo de crecimiento en relación a la pobreza histórica de la región. Utilizando ese crecimiento como punto de partida, este manuscrito localiza ese crecimiento en la Teoría de la Convergencia como una nueva forma de definir el Sur. Pruebas de Moran I Global y Local son divertidas para Área Económica Bea de Ingreso Personal Per Cápita (PCPI) para1970 y 2004, y para identificar las aglomeraciones locales del PCPI asociadas a una región de convergencia a través del tiempo. Esas aglomeraciones se utilizan para definir un Sur económicamente "funcional".

KEY WORDS: Beta Convergence, New South, Economic Development

INTRODUCTION

The American South is a region where economic, cultural, and physical characteristics work together to form a region distinct from the rest of the nation (Odum 1936). In economic and cultural terms, this uniqueness is frequently attributed to the role of the farm in the Southern economy and how the farm economy has influenced the culture of the region in contrast to the mercantile and industrial North (Henry 1988). These economic and cultural differences are most famously exhibited in the Civil War. While the concept of the South as a unique region is a common part of American history, there is a lingering question as to the actual definition of the South (Alderman and Fournier 1998). A simple definition of the South would be the Confederacy, but such a definition would ignore the cultural identification that Southerners feel about themselves (Webster and Leib 2001). This cultural identification and shared heritage can be used in the efforts to identify the South, though these efforts fail to pro-

vide either a consistent approach or regional definition (Odum 1936; Alderman and Fournier 1998; Alderman 2000). This paper proposes that an alternative method using convergence theory and spatial statistics can be used to define the South. By defining the South in economic terms, this paper can serve as a complement to the literature exploring the cultural aspects of the South, as well as serving as a starting point for greater inquiry into the growth of the Southern economy by identifying the specific regions that have experienced the noted economic growth.

EXISTING APPROACHES TO DEFINING THE SOUTH

As noted in the introduction, much of the previous research focused on defining and understanding the South has focuses on cultural aspects. Within this realm, the approaches and findings of Howard Odum and John Shelton Reed serve as a starting point. Their definitions of the South, as well as a method derived from a modern contemporary, Derek Alderman, are mapped in Figure 1. These definitions are consistent in a general southern core consisting of Tennessee, Georgia, the Carolinas, Alabama, Mississippi, and Florida. The northern and western boundaries are where the South becomes fuzzier and the South could extend in to central Texas and parts of Ohio and Indiana depending on the classification method. Odum's major contribution on the topic comes from his 1936 work *Southern Regions of the United States*. In this book, Odum examines Southern physiography, industry, and population under the traditional areal differentiation approach. The industrial and cultural portions of the book provide an understanding and mapping of the South, demonstrating that although the South has sub-regional industrial and cultural variations, the sub-regions are more similar than different compared than the rest of the nation, and can be used to help define the Southeast as a region. Another important contribution of this work is the recognition that Southern regions and sub-regions are formed as functional economic units or cultural units, and thus are unlikely to strictly follow state boundaries as seen in Figure 1. The work of Reed in the 1970s provides further insight into Southern cultural hotspots. These hotspots are constructed through the "Dixie Quotient", which maps the number of establishments with "Dixie" in their name at the city level (Odum 1976). Reed argues since "Dixie" is a part of the cultural identity of the South, it can be used as a means to identify regions with a strong Southern cultural identity. His 1990 update shows a shrinking region (Figure 1), suggesting a cultural dilution attributed to economic migrants and a greater inclusion of southern blacks in open culture (Reed et al. 1990).

More recent work also notes a Southern cultural dilution. While these papers do not set out to directly identify the South, it is impossible to engage in this work without a regional definition. Webster and Leib (2001) note a culture war occurring in former Confederate states regarding the public display of the Confederate Flag, where Southern whites used its display to fight this cultural dilution. Alderman's (2000) mapping of Martin Luther King (MLK) street names provides a unique proxy for defining the South, as by 1996 67 percent of streets named after Dr. King were in the South. Comparing the concentration of

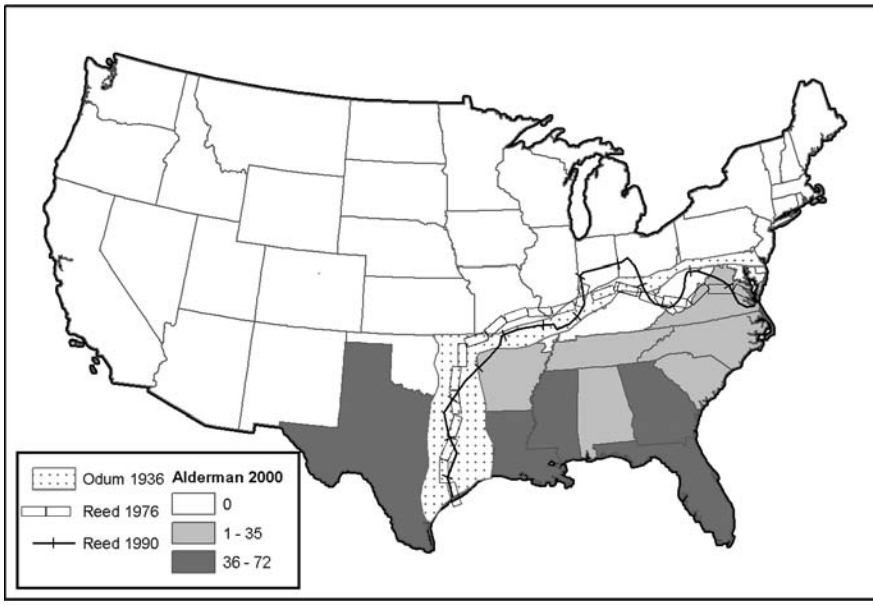

Figure 1. Common Delineations of the South.
Sources: Odum (1936); Reed (1976); Reed et al. (1990); Alderman (2000).

MLK street names to the earlier work of Odum and Reed in Figure 1, the northern edge of the concentration does not extend as far north as Odum and Reed suggest the South travels. The concentration of names in Texas extends the South much farther west than the previous work. Further work by Alderman and Alderman (2001) notes a cultural affinity for Kudzu among Southerners, providing another cultural method for Southern definition.

Recent work in economic geography can also provide some insight in to the South as a region through the "Sunbelt" literature (Wheat 1986). This body of work is also not directly focused on defining the region, but contains an implied regional definition as authors examined the economic activities of the "Sunbelt" (Breckenfeld 1977; Boren 1980). Here the "Sunbelt" is a loosely defined term that includes some combination of states in the southern or western portions of the United States (Duffy 1994). These states are linked together due to similar patterns of migration and economic growth. Newman (1983) notes that the low tax rates, low union membership rates, and an overall favorable business climate have caused a large in-migration of labor and firms to Southern states. Wheeler (1998) adds to this understanding of Southern economic growth through and analysis of textile plant locations. Reinforcing the findings of Newman, Wheeler notes the regionally cheap labor is a major force in attracting the mature industry to the South. Both of these analyses use a state based definition of the South, including states as far west as Oklahoma and as far north as West

Virginia. Henry (1988) takes a different approach in examining this economic growth, focusing on the role of the farm in Southern economic growth and culture. In the post-WWII economy, farming has been supplanted by manufacturing as the largest Southern economic activity, but a strong cultural mythology around economic importance of the farm remains. This cultural mythology persists in a region stretching westward to include both Oklahoma and Texas and north through Kentucky. The contribution of these papers to regional definition is their suggestion that there is a larger functional economic process that ties these regions together. That is, there is some economic force that is making this region stand out and attract firms from outside the region

Convergence theory can be of use in understanding this shared regional attraction of firms and population. Convergence theory suggests that regions with low initial incomes and output will grow faster than regions with higher initial income and output (Barro and Sala-I-Martin 1991). Applied to the South, several papers explore this issue. Bishop et al. (1992) note the historic poverty of the South verses the rest of the nation, and uses changes in 1970 and 1980 census state level income distributions to see if Southern incomes converged to the national mean. Here the South is defined with the Bureau of Census regional definition, which contains a western bound of Oklahoma, and a northern bound of Maryland and Washington, DC. The convergence tests show evidence that Southern incomes are catching up to the rest of the nation. Weiner (1979) examines the causes for this initial level of poverty in the South versus the rest of the nation. Regional social forces, such as class conflict and risk aversion, combine to create a social and political regime that stunted post Civil War economic growth. Alderman (2000) notes a liberalization of these social attitudes has slowly removed these barriers. However, their consequences, such as cheap labor, make the region attractive to footloose firms (Duffy 1994).

Although these papers identify a shared cultural and economic perspective across the South, a varied regional definition persists. A core group of states (Tennessee, Virginia, North Carolina, South Carolina, Florida, Alabama, Mississippi, and Arkansas) are usually included. However, the boundary of the South varies to include states associated with the west (Texas and Oklahoma), Appalachia (West Virginia), and even members of the Union in the Civil War (Maryland and Washington, DC). This inconsistency regarding the border states is consistent with Odum (1936) finding Southern boundaries not constrained by state lines. Also, these papers point to rapid social and economic change in the South. Convergence theory provides a framework for tying these cultural and economic changes together. By couching the boundary analysis though convergence theory, this paper seeks to provide a definition of the South that incorporates both of these forces.

BETA CONVERGENCE AND THE SOUTH

Introduced by Hicks (1932) convergence theory suggests that regions with lower levels of initial income or economic output will grow faster than regions with higher initial levels of income or economic output. The end result of this difference in

growth rates is that regional differences in incomes will converge towards a mean. Poor areas will grow faster and reach the mean from the bottom; while richer areas will grow slowly as the mean catches up to them. This convergence can be described in two ways: beta convergence and sigma convergence. Beta convergence refers specifically to difference in growth rates relative to initial incomes, while sigma convergence refers to a decrease in the standard deviation of regional incomes over time (Barro and Sala-I-Martin 1991).

The causes behind convergence arise from neoclassical growth theory. In a Solow-style (1956) growth model, wages and returns to investment will converge over time if there is unimpeded movement of capital and profit-maximizing behavior by firms. Assuming that firms locate to maximize returns or minimize costs, movement from mature production regions to developing regions where greater returns to investment can be realized is expected (Helleiner 1973; Hayter 1997). In the initially wealthy region, marginal returns to investment will decrease over time as technology and the production process standardizes. In those situations, moving standardized production to a region of cheap wages becomes attractive, as the cheap labor costs will reduce production costs, returns to capital investment will again be fresh, and the demand for skilled labor is negated by the standardized production process (Malecki 1997). With a global fixed capital stock, the capital investment in the new region will remove capital invested in the mature region (Schumpeter 1942). The result of this movement will cause the region with new investment to grow relatively quickly, while the region experience disinvestment will experience slower growth or decline.

The assumption of free flowing capital does not always hold since certain mechanisms can fetter capital movement. Institutional, cultural, and infrastructure barriers still exist that make capital movement across certain regions more difficult than others (Hayter 1997). Among these, governmental policy can serve to artificially attract or repel firms (Smith 1966; Gertler 2001). The evolution of the transportation network has also opened up previously distant regions now available for branch plant location (Hayter 1997). Applied to the South, the removal of these barriers resulted in a radical transformation of the regional economy (Malecki 1995; Graves 2006). Historically, the Southern economy has been dominated by agricultural production, and the importance of agriculture permeated through both the economic and cultural identity. Prior to 1950, manufacturing was present, though below national averages and focused in mature sectors that could take advantage of regional-wide low cost of labor and strong work ethic (Johnson 1997). The growth of this manufacturing was limited due to a regional lack of infrastructure and lack of capital for investment (Mitchner and McLean 2003; Graves 2006). Thus, the region remained in relative poverty (Graves 2006). By the latter half of the 20th Century, the region saw improvements in infrastructure and a cultural liberalization making the region attractive to outside investment (Alderman 1987; Wright 1987). Initial growth saw an increase in the number of branch plants in rural locations (Park and Wheeler 1983; Malecki 1995). Although the cheap regional labor remains

important to firm location in the South, industry has diversified and spread to the point where there was no single industrial core (Johnson 1997). Rural locations continue to be home for branch plant locations, while urban areas host a burgeoning local industrial base (Park and Wheeler 1983). This spread of capital has created a "trigger effect" for 2nd and 3rd order multipliers that spur even more growth (Johnson 1997). However, despite this economic expansion, the side effects of historic poverty still stunt growth through a general lack of available capital for investment, as well as a cultural aversion to risk (Graves 2006; Graves and Woody 2006). However, the evidence of growth presented in these papers, in conjunction with the well known poverty of the South, does provide a suggestion that there is a convergence process occurring. With the regional nature of convergence, the region of Southern convergence should be definable.

In the discussion of the factors that influence convergence, the concept of the region maintains a high level of prominence since rates of growth are compared at the regional level. Labor markets, infrastructure levels, and market proximity are all discussed regionally. In regional processes such as these, there is a growing literature examining spatial dependence, the operationalization of Tobler's First Law of Geography (Anselin 1988). Spatial dependence occurs in situations where the presence and magnitude of a variable cannot be explained by just attribute values in a specific location, but in conjunction with the presence and magnitude of that same value of an areas' neighbors. Applied to convergence, the role of spatial dependence is well understood (Armstrong 1995; Rey and Montouri 1999). These regional effects can be accounted for with dummy variables, but true nature of these effects are best accounted for with a spatial error model (Henley 2005). The reason behind the importance of spatial dependence in convergence relates to the fact that the initial causes setting up the potential convergence, such as an underdeveloped infrastructure or cultural bias against unionization, are spatially autocorrelated. Thus, when a region is converging, the role of this initial spatial dependence directly influences the convergence output measurement.

DEFINING A REGION

Boundary analysis and cluster detection contain a series of analytic techniques that have grown in scope and application as GIS analysis has become more widespread. For geographers, the study of boundaries and their evolution is frequently classified in to three categories; evolution of boundary definition, evolution in boundary position, and state functions at boundaries (Prescott 1987). In human geography, boundaries are dynamic and influenced by both the underlying cultural landscape as well as the economic transactions that occur across them (Prescott 1987). With this dynamic nature of boundaries, regional definitions need to be revisited periodically (Prescott 1987). Boundaries are considered crisp if they are well defined and fuzzy if they are not (Jacquez et al. 2000). In addition to sometimes being fuzzy, boundaries are not always static and may change over time (Prescott 1987). The process of boundary

analysis and cluster detection seeks to define objects on spatial fields with a goal of trying to understand the spatial relationships underpinning the studies themselves (Jacquez et al. 2000). While boundaries and clusters are different and have different techniques for detection, they are related as a cluster infers a boundary, and the output from the analysis can be used to measure spatial association for confirmatory models (Jacquez et al. 2000; Jacquez et al. 2008).

There are many methods for boundary and cluster detection, and their appropriateness varies depending on the data structure and scale of analysis (Jacquez et al. 2008; Fortin et al 2000). A broad group of methods that seek to identify boundaries through the use of surface modeling are the wombling approaches. These methods are named after the work of Womble (1951) who first identified the method of identifying zones of rapid change through an analysis of the surface gradient produced by the data. Wombling approaches operate under the assumption that the zone of rapid change is the buffer between regions of dissimilar values, and thus serves as the boundary between the regions. These approaches are frequently applied to point and raster data, though are rather underdeveloped for polygon data and susceptible to data confidentiality issues in human geography (Lu and Carlin 2005). Local statistics can be used to identify clusters of unnaturally similar of different values. These types of analyses operate under the assumption that if a boundary is between two areas, the differences in their measures should be large, and thus not parts of the same cluster (Boots 2001). Anselins' LISA and Getis-Ord statistics and their derivatives are the most frequently used local statistics used to identify clusters of similar activity (Jacquez et al. 2008; Philibert et al. 2008). These types of approaches offer an advantage of being able to test against the spatial null hypothesis of no association, although they are limited by the neighbors defined in their spatial weight matrix (Jacquez et al. 2000; Jacquez et al. 2008).

Applied to studying convergence and the Southern economy, the polygon cluster analysis techniques offer the ability to identify the converging region. Convergence is an inherently regional process, where the clustering of wealth, poverty, and growth are central to the theory. The distribution of wealth is known to be unequal and concentrated in the beginning of the convergence period. The polygon spatial statistics provide a method for identifying the regions of wealth and poverty that are significantly different from each other. The identified regions should then exhibit a specific behavior; the region of initial poverty should experience a fast growth rate that is constrained to the region, while the region of initial wealth should show a growth rate that is indistinguishable or lower than the expected mean. The local statistics offer a method for not only identifying the regions of unequal distribution and growth, but also provide a mechanism for testing against the spatial null.

DATA AND METHODS

The goal of this paper is to provide an alternative definition of the South through convergence analysis. Convergence is spatial process, where regional attributes are

used to explain differences in growth rates. To apply this understanding in a manner that can be used to extract a regional definition form the South, the data needs measure initial income conditions, final income conditions, and the changes in income over the time period. The measure of initial incomes is used to identity locations of initial poverty are theorized to grow quickly, the end income is compared to the initial levels to see if those income have changed, and the change measure is used to measure the magnitude of the change. Spatial statistics are used to find clusters of significantly similar values, a process that defines regions and implies boundaries. If the South has been converging, there should be clusters of similar values of income in the South at the beginning, end, and in change.

The data and time period used in this paper is Per Capita Personal Income for 1970 and 2004 as a percentage of the national mean, and comes from the Bureau of Economic Analysis Regional Economic Information System. The analysis begins at 1970, the start of the last decade of the fourth Kondratieff, a period of Fordist production concentrated in the Rust Belt. (Hayter 1977). The fifth Kondratieff, starting in the 1980s is characterized by the flexible production process that helped spur Southern industrial growth (Bishop 1992). Starting in 1970 should capture the entirety of the wave. Ending in 2004 is necessitated as the 2005 hurricane season provided a textbook case of an exogenous event affecting data (for example, the 2005 New Orleans PCPI was 15 percent of the national average and has yet to recover). PCPI change is calculated with the following formula:

$$C_i = \frac{\left(\frac{PCPI_i^{2004}}{PCPI_I^{2004}}\right)}{\left(\frac{PCPI_i^{1970}}{PCPI_I^{1970}}\right)} * 100 \quad (1)$$

Where:
C_i = PCPI Change in EA
$PCPI_i$ = PCPI in EA i
$PCPI_I$ = Mean National PCPI

This measurement provides 2004 PCPI as a percent of 1970 PCPI. A region with no change in PCPI will have a value of 100, while a growing will have a value greater than 100, and a region with a negative change will have a value of less than 100. The use of this measure instead of simple change is necessitated by the fact that negative numbers are not handled consistently in spatial statistic applications across software vendors, some packages convert the negative values to 0, and others do not. By removing the possibility of negative numbers, this is robust against different results from different packages. Also, it is worth noting that change is going to be relative to initial PCPI levels. A region with a low initial level will be able to experience a large rate of change because of the initially low level. Since convergence is dependent on initial incomes, this possible inflation of rate of change is built in to the theory.

Data are aggregated at the Economic Area level. Economic Areas are defined by county commuting patterns and are the functional economic regions used by the Bureau of Economic Analysis (BEA) (Johnson and Kort 2004). As functional economic units, they should be self-contained, and any spatial dependence is a result of a larger spatial process (Barkley et al. 1995). Economic Areas are continuous across the

United States, making the definition of neighbors a pure contiguity measure. They are small enough to facilitate a bottom up approach in the regional definition, which is consistent with the initial work of Odum (1936).

Out of the boundary and cluster detection methods for polygon data, Moran's I and the Getis-Ord are the typical options. Moran's I is the most widely used spatial autocorrelation test, and has the advantage of having both a global and local test (Cliff and Ord 1982; Anselin 1995). At the global level, the test does not identify individual clusters, but tests for spatial autocorrelation beyond the expected, as expressed in Tobler's Law (Anselin 1995). Values for Moran's I range from -1 to 1, with negative values indicating an unnatural clustering of dissimilar values, while positive values indicate a clustering of similar values. The expected value is not 0 but a slightly negative number based upon the number of observations, so interpretations must be checked against the p-value of the statistic. (Wong and Lee 2005). For the purposes of this exercise, the global Moran's I is calculated as:

$$I = (n\Sigma\Sigma w_{ij}(x_i - \bar{X})(x_j - \bar{X}))/ W\Sigma(x_i - \bar{X}) \quad (2)$$

Where:
x_i = PCPI at Economic Area i
x_j = PCPI at Economic Area j
W = spatial weight matrix

This equation only calls for two inputs; the PCPI (as a percent of the US mean) for all *i's* and a spatial weight matrix *W*. The spatial weight matrix is defined by assigning neighbor *j* to area i a value of 1, and all other observations a value of 0. This removes the non-neighbors from comparison in the numerator, where neighbors are compared to the mean as a covariance. The denominator is a simple reflection of the distance of the value at *i* from the mean.

The local version of Moran's I is Anselin's LISA (Anselin 1995). This statistic breaks apart the global Moran's I to its component values by observation and tests for statistical significance against an expected random (though simulated) distribution. These results can be mapped to identify the relative hot spots (areas of high value), cold spots (areas of low value), and the areas of dissimilar values (where the presence of an attribute in one region drives that attribute away in neighbors). The core EA for these hot spots, cold spots, and spatial outliers are displayed in a LISA cluster map. The EAs noted are those that were the center of a significant (0.05) cluster, and thus are indicating that it is not just the EA identified as significant, but also its neighbors based upon the neighborhood definition.

The interpretation of the global and local Moran's I go hand in hand. At the global level, the Moran's I statistic can be used to identify the presence and nature of underlying spatial processes. The presence of spatial autocorrelation is tested against the spatial null, where the hypothesis is that the variable is randomly distributed across space. If a variable is spatially random, the Moran's I would produce a p-value that fails to reject the spatial null, implying the presence of a variable in one region neither attracts nor repels the same variable in its neighbors. With a significant global Moran's I, the LISA statistics can be used to identify the specific locations and nature of the spatial processes. The hot spots (high-high) indicate an unnatural clustering of high values, indicating that the presence of the

variable in one location attracts that same variable to its neighbors. Cold spots (low-low) are the exact opposite of hot spots. These are places where the absence of a variable in a location also causes that variable to have an unnaturally low presence in its neighbors. The spatial outliers (low-high; high-low) are where the presence of a variable in one location has a repulsive effect on its neighbors. A location with a low level of a variable (low-high) will be surrounded by relatively high values in its neighbors, as the absence of that value at the core of the cluster makes its neighbors attractive locations for that same variable. Clusters of low values around a high value (high-low) are places where the presence of the variable in the core of the cluster repels that variable from its neighbors.

Applying the Moran's I statistics to convergence analysis is rather simple. These statistics provide a mechanism to identify the initial hot and cold spots, as well as the hot and cold spots of change. Previous papers suggest there to be a convergence process effecting the South, and these statistics provide a means of identifying the regions and magnitude of this process. First, the Global Moran's I is calculated to test for overall spatial autocorrelation. The tests are run using both first order and second order neighbors to examine the extent of the regional dependence and to reduce the bias that only one neighborhood definition may provide. In 1970 and PCPI change, there should be a significant spatial autocorrelation if convergence is present, with Southern poverty and Rust Belt affluence influencing the statistic. PCPI change should also show a significant positive Moran's I due to the rationalization of growth rates in converging economics. The 2004 Moran's I should show a lesser degree of autocorrelation as convergence has lessened relative income disparities. In the LISA analysis, the South should be an initial cold spot running through the southeast, reflecting the historic poverty of the region. This will serve as a starting, albeit rough, definition of the South. By 2004, the Southern cold spot should be smaller in size and magnitude. The LISA map for the PCPI change should reflect a large hot spot in the southeast, reflecting the more rapid growth of the initially poor region.

RESULTS AND DISCUSSION

The descriptive statistics for 1970 PCPI, 2004 PCPI, and PCPI change are shown in Table 1. PCPI for 1970 in the study area ranged from 49 to 129, with a mean of 86.7. Two characteristics of the data allow the mean not to be the national average of 100; Hawaii and Alaska are omitted due to their lack of contiguity, and BEA PCPI is calculated at the individual level and aggregated nationally, and Economic Areas are slightly different level of aggregation. This suggests an unequal spatial distribution of income, which is confirmed by the failure of the Shapiro-Wilk normality test. The 2004 PCPI ranges from 48 to 130 with a mean of 87.2, representing a larger range than in 1970. This small expansion in range did not normalize the distribution, as it also failed the Shapiro-Wilk test. Change ranges from 77.4 to 128.6, with a mean of 101.4. This shows that on average, the EAs show growth across the board. The distribution is more normal, as it passes the Shapiro-Wilk W.

The initial 1970 conditions are mapped in Figure 2. The Global Moran's I for this

Table 1: Descriptive Statistics

	Minimum	Maximum	Mean	Std Deviation	Shapiro-Wilk Normality	Normality Decision
1970 PCPI	49	129	86.7	14.21	0.98	Reject Normality
2004 PCPI	48	130	87.21	12.56	0.94	Reject Normality
PCPI Change	77.42	128.57	101.44	10.14	0.99	Cannot Reject

map is 0.51 (Table 2), which is significant and positive. The positive value and significance indicates a strong rationalization effect present with values surrounding themselves by similar values, consistent with the initial condition expectations of beta convergence. In Figure 2, this regionalization becomes more concrete. There is a strong cold spot band running through a core of Arkansas, Tennessee, Georgia, Alabama, Mississippi, with another cold spot core in the Carolinas in the first order analysis. This swath of significant low values fits with the expectation that before convergence takes place, there is a region of relative poverty. In this case, it is in the South. Three low-high clusters are present in the region; the Atlanta, Jackson, and Greensboro EAs. Their role as low-high spatial outliers indicates that they are spots of relatively high income standing in stark contrast to their neighbors' low income, reinforcing the relative regional poverty. In the second order neighborhood definition, the Southern swath of relative poverty remains (Figure 2). The band covers roughly the same locations, with the notable exception that it extends further west, with high-low outliers in Texas. With the larger neighborhood definitions, this is not unexpected. The large EAs in Texas are easily drawn in by the larger neighborhood definition, and thus are compared to areas such as Little Rock and Jackson. But, the second order analysis does confirm that there is potential for convergence through the cold spot band running in the South. The significant and positive Global Moran's further confirms a significant degree of spatial dependence (Table 2).

The 2004 analysis also fits with the expectations of convergence. The first order Global Moran's I of 0.20, though still positive, is not significant which indicates the concentration of PCPI is less strong than in 1970 (Table 2). In conjunction with the Global Moran's I, the Southern region of comparative poverty has largely disappeared in the first order LISA analysis (Figure 3). There is still a cold spot cluster in southern Georgia, one in Arkansas, and two high-low clusters in Memphis and Jackson. The shrinking of the Southern cold spot provides further evidence that the incomes in the South are converging to the national mean. The second order analysis supports this conclusion. In fact, parts of the region show up as high-low outliers (Figure 3). While this does indicate that there are still some low PCPI economic areas, their relatively low values are now quite different from the neighbors and the national PCPI distribution. The Global Moran's I is less than the previous examples, indicating a decline of the spatial dependence of PCPI over time.

The Global Moran's I for first order change shows strong positive spatial auto-

Table 2: Global Moran's I Values

	Moran's I First Order	Significant (0.005)?	Moran's I Second Order	Significant (0.005)?
1970 PCPI	0.5105	Y	0.3018	Y
2004 PCPI	0.2027	Y	0.0962	N
PCPI Change	0.4501	Y	0.2698	Y

correlation (Table 2). This indicates that the areas experiencing the fastest growth are surrounded by also fast growing areas. The LISA clusters are mapped in Figure 4. The South shows up as a hot spot stretching from Arkansas eastward, including Tennessee, most of the Carolinas, parts of Louisiana, Mississippi, Alabama, most of Georgia, and the Florida panhandle. Since these are the cores of the clusters, the actual high value band extends one EA out along the entire perimeter. The second order analysis tells a similar story. The northern bound does not move very much, suggesting that the northern boundary to the South follows the northern boundaries of Tennessee and North Carolina. There is some spillover to Kentucky and Virginia, but these spillovers are along the southern state boundary, and are thus more reflective of cross border relationships instead of an actual northern movement of the South. The South does not extend to Texas, and is generally confined to the eastern and central portion of Arkansas and Louisiana. Florida appears to be largely economically independent from the rest of the South. The only portion of Florida to appear as a part of the Southern cluster is a portion of the panhandle in the second order map. This southern boundary is the fuzziest of the lines, and can be included in the South correctly dependent on the neighborhoods defined.

Comparing these results to previous definitions of the South, a few things become clear. The economic south does not follow state boundaries, which is consistent with findings of Odum. Compared to these results, larger portions of Virginia and Kentucky are included in his broad-spectrum analysis, while the convergence analysis suggests that these states may not have quite as strong of an economic tie to the South. Odum's exclusion of Texas and placement of the western boundary in the western portions of Louisiana and Arkansas remain consistent with this analysis. Florida is a unique case, as it is the southeastern terminus of the Unites States, but also culturally and economically influenced though its unique status as a destination for both internal and international migration. While a case can be made for the inclusion of the northern part of Florida, central and southern Florida do not appear to be a part of the same economic processes of the panhandle. Figure 5 shows the EAs that appear as hot spots in PCPI change using both neighborhood definitions. These EAs represent a southern core, or the economic areas that functionally showed as the cores of the spatially dependent convergence in the South. These are the economic areas that make the strongest case for being classified as the South. Under this definition, the western edge reaches to central Arkansas and

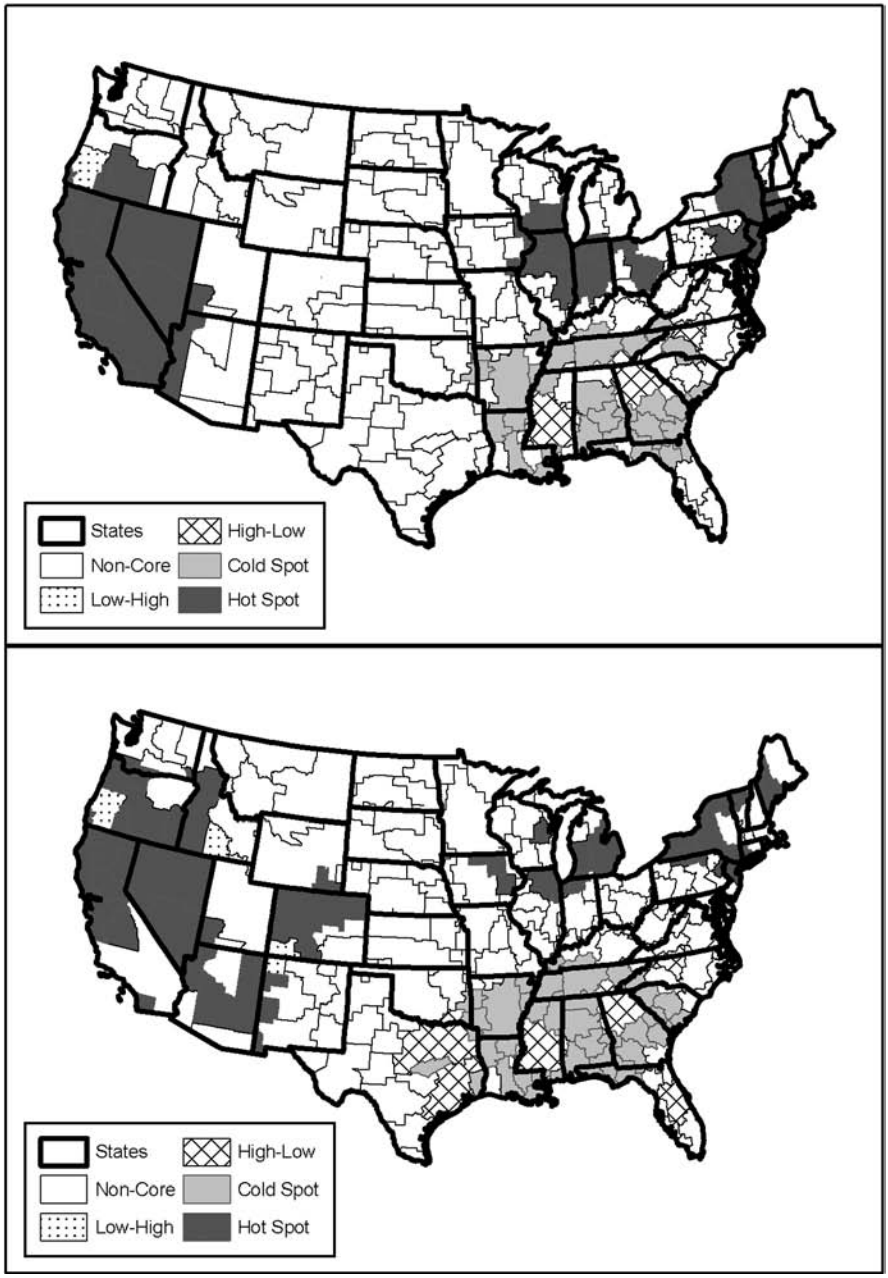

Figure 2. 1970 PCPI Clusters. First order weighting (top) and Second order weighting (bottom).

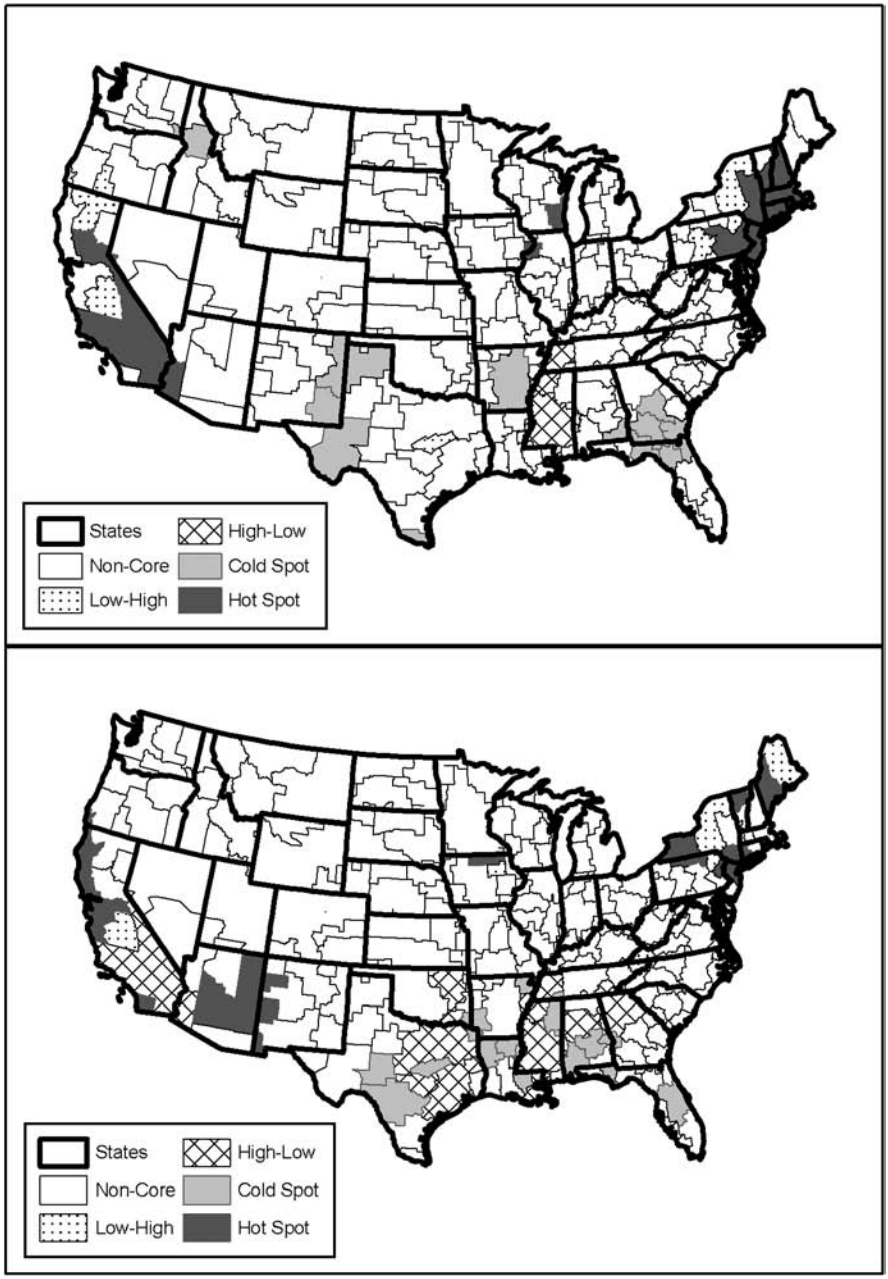

Figure 3. 2004 PCPI Clusters. First order weighting (top) and Second order weighting (bottom).

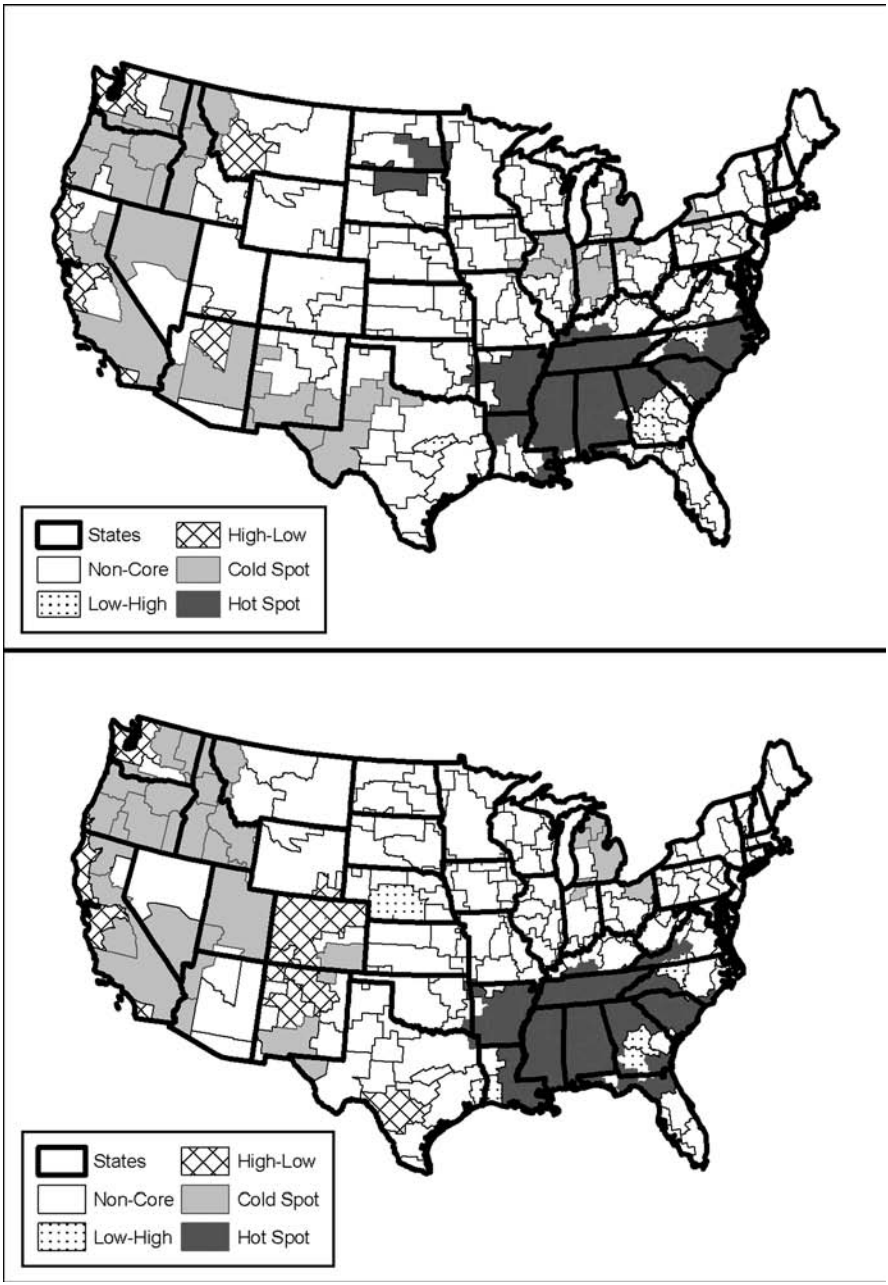

Figure 4. PCPI Change Clusters. First order weighting (top) and Second order weighting (bottom).

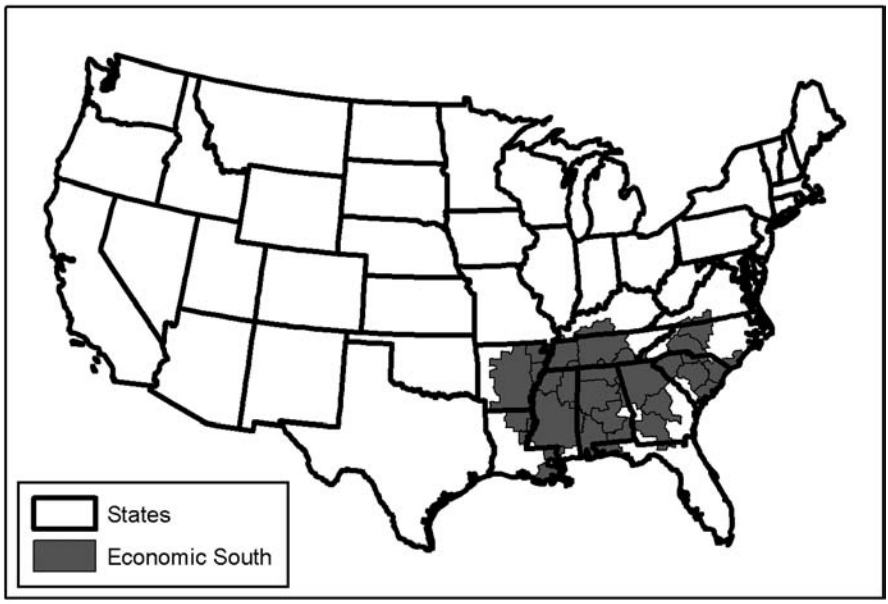

Figure 5. The Functional Economic South.

northwest Louisiana, has a southern edge along the northern Florida border, has a northern edge generally along the Tennessee and North Carolina northern state lines, and has a jagged eastern edge that follows central Georgia, all of South Carolina, and has a northern "peninsula" of the North Carolina Piedmont. The coastal areas of North Carolina and Georgia, notably, are not included in this boundary. They are the neighbors to the central North Carolina and Georgia core economic areas, and thus are a part of the clusters, but not cores themselves. This is simply a result of a border effect, as those counties did experience growth during the study period, and thus could be included in the South under a more loose definition. Of greater interest is the exclusion of the Appalachian EAs in eastern Tennessee and western North Carolina. These areas do not have a similar rapid rate of growth to their neighbors, and thus are not core counties, although still a part of the clusters centered on their neighbors. The mountainous terrain still makes them expensive places for production, and likely impacted their relative slower growth.

While defining the South through this methodology provides a supplement to the cultural definitions and presents evidence of convergence, it should not be inferred that the South has converged. The LISA maps of change show there to be a strong region of relatively rapid growth, but there is an uneven growth process occurring. Malecki (1995) and Johnson (1997) note that the growth is marked by urban/rural differences in investment (Branch plants vs. locally owned), with the branch plants providing a less stable mechanism for growth. Further, looking at

a region of historic poverty within the South, such as the Mississippi River Cultural Delta, can add further insight to the process. While the EAs in the Delta show up as hot spots of change, 119 for Memphis and 116 in Jackson, their 2004 incomes were still below the national mean (88 and 73, respectively). So, while these areas did experience rapid growth, it is possibly inflated by the extreme poverty of the region initially.

CONCLUSION

One of the persistent themes in Southern studies has involved a fuzzy definition of the South. Early work by Odum notes uniquely Southern cultural and economic attributes that set it apart from the rest of the nation. However, the boundary between the South and other regions is fuzzy and does not follow state lines. Work since focuses more on the attributes of the South, while failing to provide a uniform definition. This further work notes a Southern cultural and economic transition. Culturally, the South is experiencing a conflict between traditional and more liberal cultures playing out in areas such as street naming. Economically, the "Sunbelt" is a region noted for its rapid rate of growth. The growth of this historically poor region at a faster rate than the more developed regions can be explained through convergence theory.

Convergence theory simply dictates that regions with low initial incomes will grow faster than regions with higher initial incomes. This type of growth is known as beta convergence. The South has been shown to be undergoing beta convergence since the 1970s. Given the strong regional component in beta convergence, spatial dependence has been shown have a strong presence in modeling it. This paper set forth to use statistical measures of spatial dependence, the Global and Local Moran's I, to identify the South as a region through convergence data.

Using PCPI as a percent of the national mean, Moran's I and LISA statistics are run for BEA Economic Areas for 1970, 2004, and their change. The initial LISA maps for 1970 PCPI show a strong cold spot in the Southeast, indicating the potential for regional convergence. By 2004, the regional significance in the South has largely dissipated, suggesting that the South has pulled itself up relative to the rest of the country. The LISA maps for PCPI change show the South to be a regional hot spot of growth. Using the core EAs of the hot spots as the strictest definition of the South, the region becomes clearer. The South begins roughly along the Tennessee and North Carolina state lines, although there are some county spillovers to Kentucky and Virginia. The southern edge of the South is generally along the northern border of Florida. Central Arkansas provides the western edge for the South, while a jagged edge along the east defines the South as following the Piedmont and not extending to the Atlantic Coast.

This paper provides an alternative means for defining the South through economic growth. However, it this is far from the only way to define the South. Similar approaches using spatial dependence could be applied to cultural attributes, such as metrics of cultural dilution or an updated Dixie Quotient. Spatial statistics allow for quantitative boundary definition techniques to supplement the original ideas of Odum. The definition created from this paper can be used as a supple-

ment to the existing cultural definitions. Also, the spatial statistics used give insight to the underlying spatial structure of Southern economic growth, and can thus serve as a starting point for more detailed confirmatory economic studies.

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