Public Expenditure and Poverty Reduction in the Southern United States

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Abstract: The objective of this research was to analyze the effects of education, health and hospital, parks and recreation, and public welfare expenditures on poverty, focusing particularly on how these relationships change over space and time. Government expenditure on parks and recreation has been the single most effective government expenditure category over time, although the marginal effects of the government expenditure on poverty alleviation have weakened over time. Clusters of the highest marginal effects of government expenditures on poverty reduction were identified for each time period using geographically weighted regression (GWR) and analysis of local indicators of spatial association (LISA).

Keywords: government expenditure, GWR, poverty, southern United States

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Introduction

Since 1964, when President Lyndon Johnson declared war against American poverty, researchers and policy makers have continuously struggled to develop ways of reducing poverty. Through their efforts, a significant amount of research and Federal Government funding has been direct toward the poverty issue. For example, Appalachian Regional Commission (ARC) was formed by the Federal Government in 1964 to improve the standard living. This program included grants, direct loans, guaranteed loans, and direct payments for retirees (Reeder and Calhoun 2002). Despite these efforts, the poverty rate in the United States still rose for four consecutive years from 11.3% in 2000 to 12.7% in 2004 and has remained fairly constant in more recent years, i.e., 12.3% in 2006 (DeNavas-Walt, Bernadette, and Smith 2007). Thus, notwithstanding the poverty-alleviation efforts of the last four decades, poverty is still a multi-dimensional phenomenon about which causes, conditions, and consequences remain difficult to identify, disentangle, and quantify.

Several researchers have investigated the effects of changes in economic, social, political, and demographic conditions on the poverty rate. A key element affecting poverty is regionality. Levernier, Partridge, and Rickman (2000) concluded that economic development targeting predominantly African-American communities and non-MSA counties would be most effective in alleviating poverty. Triest (1997) concluded that increased employment of the low-income population and increased educational opportunity would narrow the interregional gap in poverty. Rupasingha and Goetz (2007) suggested that government can increase investment in social capital to reduce the poverty rate by easing transaction costs paid by local associations.

Swaminathan and Findeis (2004) found that welfare assistance to help the poor workers had effects on poverty in metro areas. Mauro (1995) found that the poor countries tend to have corrupted bureaucracies and politic instability.

Ethnic diversity is another important factor in explaining poverty. Berthoud (2002) reported significant relationships between ethnicity and poverty for some groups in Great Britain. Alesina, Baqir, and Easterly (1999) concluded that the level of ethnic diversity within a community is inversely related to spending on public goods such as education, which may adversely affect the poverty rate. Montavlo and Reynal-Querol (2005) found an inverse relationship between ethnic diversity and economic development. Industry composition also can affect the poverty rate. Levernier, Partridge, and Rickman (2000) demonstrated that counties with above-average shares of employment in agriculture, trade, and services have higher poverty rates. Education is another key for reducing poverty rate for the counties with minorities (Swail, Redd, and Perna 2003)

Some researchers have addressed the effects of public expenditures on poverty in developing countries. Fan, Hazell, and Thorat (2000) investigated how government spending affects poverty in India and found that expenditures on roads, research, and development have the largest impacts. Fan, Linxiu, and Xiaobo (2002) concluded that government expenditures on rural education and infrastructure reduced the rural poverty rate. Jung and Thorbecke (2003) found that increased expenditure on education, followed by an excess supply of more educated and skilled labor, can contribute to economic growth and poverty alleviation. Gomanee et al. (2005) found that public spending on social services was not effective in reducing poverty and highlighted the need for new techniques to improve the efficiency of public spending.

Although previous research focused on key poverty issues applicable to formulating poverty reduction policies, none explicitly considered both the temporal and spatial dynamics of local government spending on poverty. Quantitative estimates of the relative effects of local government spending on poverty are essential to making informed policy and planning decisions regarding poverty reduction. Thus, the objective of this research is to analyze the effects of local government spending on poverty, focusing particularly on how this relationship changes over space and time. This objective is addressed by estimating spatially-varying marginal effects of local government expenditures on poverty rates using geographically weighted regression (GWR). The temporal dynamics are evaluated by applying the GWR model to county-level data for 1990 and 2000.

Empirical Model

The GWR Poverty Model

The marginal effects of local government expenditures on poverty may vary over space if characteristics of poverty vary from one location to another. Research has shown that an equal government expenditure across locations may not affect poverty uniformly because economic, social, political, and demographic characteristics vary regionally (e.g., Fan, Hazell, and Haque 2000; Fan, Zhang, and Zhang 2000). Following the GWR approach suggested by Fotheringham and Brunson (1999), the poverty model is expressed as:

$$(1) \qquad y_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i, \; i = 1, \ldots, n, k = 1, \ldots, \mathrm{m},$$

where y_i is the poverty rate in county *i* among *n* counties; x_{ik} is the k^{th} variable among *m* variables representing government expenditures and other economic, demographic, and social characteristics in county *i*; ε_i is a random error; (u_i, v_i) denotes the location coordinates for the

centroid of county i ; and $\beta_0(u_i, v_i)$ and $\beta_k(u_i, v_i)$ are localized parameters for county i. The GWR model is estimated for 1990 and 2000 to evaluate the temporal dynamics of the effects of local government expenditures on poverty, and for simplicity, the year subscript is suppressed.

The GWR estimator is:

(2) $$\hat{\beta}(u_i, v_i) = (X^T W(u_i, v_i) X)^{-1} X^T W(u_i, v_i) p,$$

where $\hat{\beta}$ is an estimate of β and $W(u_i, v_i)$ is an n-by-n matrix whose diagonal elements indicate each county's geographical weight for the "regression point" *i.* The GWR model assumes that counties close to county *i* have more weight in the estimation than the ones far from it, allowing estimation of spatially varying coefficients (Fotheringham, Brunsdon, and Charlton 2002).

Different kernel functions $K(d_{ij} / d_{\max}(q))$ determine the diagonal elements of the weight matrix, w_{ij}. That is, for all $d_{ij} \geq d_{\max}(q)$, $K(d_{ij} / d_{\max}(q)) = 0$ where d_{ij} is the Euclidean distance between points *i* and *j*, and $d_{\max}$ is the maximum distance between observation *i* and its *q* nearest neighbors (optimal bandwidth). Following Fotheringham, Brunsdon, and Charlton (2002), we used the Gaussian kernel, with $K(d_{ij} / d_{\max}) = \exp\left[-(d_{ij} / d_{\max})^2 / 2\right]$.

A cross-validation (CV) approach is used to select the optimal bandwidth (Cleveland and Devlin 1988). One problem with using the bandwidth from the CV approach is that it may not adequately address spatial autocorrelation (Cho, Jung, and Kim 2008; Fotheringham, Brunsdon, and Charlton 2002; Leung, Mei, and Zhang 2000; Páez, Uchida, and Miyamoto 2002). The GWR residuals using the bandwidth from the CV function were tested for spatial autocorrelation by a Lagrange Multiplier (LM) test. In this analysis, a row-standardized inverse distance matrix was applied to construct the test statistic (Anselin 1988) using a spatial contiguity weight matrix.

The statistic is distributed as a $\chi 2$ variate with 1 degree of freedom. The null hypothesis of no spatial autocorrelation is tested.

If the LM test for spatial error shows that the residuals from the GWR model using the CV approach are spatially autocorrelated, the bandwidth is increased or decreased gradually until significance of spatial autocorrelation no longer exists at the 5% level. The GWR 3.0 (Fotheringham, Brunsdon, and Charlton 2002) and MATLAB (The MathWorks, Inc. 1992) software packages were used for regression and LM testing. Henceforth, this mixed approach to identify the bandwidth using the CV function and LM statistic is called the CV-LM approach.

Identifying Consistent Poverty Counties

To see if poverty in the South is not random, Moran's index is estimated. The index is a measure of the overall spatial relationship across geographical units and is defined as $I = [n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(y_i - \bar{y})(y_j - \bar{y})]/[(\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij})\sum_{i=1}^{n}(y_i - \bar{y})^2]$, where n is the sample size, y_i is the poverty rate in county i with sample mean $\bar{y}$, and w_{ij} is the distance-based weight which is the inverse distance between counties i and j. Like a correlation coefficient, Moran's index takes on values greater than zero (signifying positive spatial autocorrelation, e.g., similar, regionalized, or clustered observations), equal to zero (indicating a random pattern), and less than zero (implying negative spatial autocorrelation, e.g., a dissimilar or contrasting pattern) (Goodchild 1986, p16-17).

If Moran's index demonstrates that the spatial distribution of poverty rate in the South is not random, local indicators of spatial association (LISA) (Anselin 1995) are estimated to identify spatial clusters of poverty. LISA values indicate the extent of spatial autocorrelation between the poverty rate in a particular county and the poverty rates in the counties around it.

Through inference analysis, spatial clusters of poverty, or poverty 'hot-spots' (high-poverty counties surrounded by high-poverty counties), are identified. These clusters can include a single county and its contiguous neighbors, or a larger set of contiguous counties for which the LISA values are statistically significant. The LISA value for county *i* is defined as:

$$LISA_i = [(y_i - \bar{y}) / \sum_{i=1}^{n} y_i^2] \cdot \sum_{j=1}^{n} w_{ij}(y_j - \bar{y}) .$$

The 'hot-spots' identified by LISA analysis are used to screen counties for policies targeted at poverty alleviation. The average local marginal effects of different government expenditure categories within each hot-spot cluster are summarized. These summaries quantify the relative importance among government expenditure categories in alleviating poverty.

A likelihood ratio (LR) test is used to test whether the GWR models for 1990 and 2000 should be estimated separately, or with a single, pooled regression. Denoting the maximum log-likelihoods for the 1990, 2000, and pooled regressions (with year dummy variable in the equation) as f_{1990}, f_{2000}, and f_P, respectively, with corresponding numbers of parameters k_{1990}, k_{2000}, and k_P, the LR statistic $2(f_{1990} + f_{2000} - f_P)$ is Chi-square distributed with $(k_{1990} + k_{2000} - k_P)$ degrees of freedom. Failure to reject the null huypothesis of parameter equality between the 1990 and 2000 regression, would indicate that separate regression for the two years is appropriate.

Study Area and Data Description

This study focuses on 1,195 counties in 12 of the 16 states in the U.S. Census Bureau's South Division. The states are Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Tennessee, Georgia, South Carolina, North Carolina, Kentucky, and West Virginia. Florida, Maryland, Delaware, and Virginia were excluded because their average poverty rates were below

the national average for 2004─2006, and poverty has not been a prevalent phenomenon (U.S. Census Bureau 2006, see Table 1).

The southern United States is selected as the study area because of persistently higher poverty rates than other regions. In 2006, the South had the highest poverty rate at 13.8% while other regions had significantly lower rates, e.g., 11.5% in the Northeast, 11.2% in the Midwest, and 11.6% in the West (DeNavas-Walt, Bernadette, and Smith 2007). The so-called "Southern Black Belt", which includes Appalachia, Mississippi Delta, and Rio Grande Valley are often identified as poverty areas. Poverty rates in these areas were above-average in 1990 (Friedman and Lichter 1998). The Southern Black Belt refers to the old plantation belt of the southern coastal plain, ranging from southern North Carolina through Louisiana and the Southern Highlands in Allegheny to the Cumberland Plateau country of Kentucky and West Virginia. Persistent poverty, low employment and education, poor health, and high infant mortality remain prevalent in the area (Beale 2004; Calhoun, Reeder, and Bagi 2000; Williams 2002).

The study employs four county-level datasets in a geographical information system (GIS): (a) demographic and industry structural data for 1990 and 2000 from the U.S. Census Bureau, (b) employment data for 1990 and 2000 from the Bureau of Labor Statistics, U.S. Department of Labor, (c) data on employment of art occupations and Rural/Urban Continuum Codes for 1993 and 2003 from the Economic Research Service, U.S. Department of Agriculture, and (d) county government expenditure data for 1987 and 1997 from the U.S. Census Bureau Government Finances. Government expenditures for 1987 and 1997 were chosen to capture the lagged effects of government expenditures on poverty rates in 1990 and 2000, respectively. The 1993 and 2003 Rural/Urban Continuum Codes were used as proxies for rural/urban counties in

1990 and 2000, respectively. Variable names, definitions, and descriptive statistics for the variables used in the GWR models are presented in Table 2.

Empirical Results

The null hypothesis that all slope parameters (i.e., except the constants) are equal is rejected (LR = 354.9, df = 22, p-value < 0.001), suggesting that the inclusion of a year dummy variable in the pooled regression does not fully capture time differences over the decade and, thus, separate 1990 and 2000 regressions are appropriate.

The adjusted R^2 s are 0.92 and 0.90 for the 1990 and 2000 regressions, respectively, and the Akaike Information Criterion are 5,921.99 and 5,423.23 for the 1990 and 2000 regressions, respectively. These statistics indicate that GWR using the CV-LM approach fit the data well. The bandwidths using the CV-LM approach are 185 and 287 observations for the 1990 and 2000 regressions, respectively. Because each GWR model generates too many coefficients, i.e., the $\hat{\beta}(u_i, v_i)$ matrix is $n \times (m+1)$ resulting in 274,462 different coefficients for the 1990 and 2000 regressions, the summaries of GWR parameter estimates (i.e., lower quartiles, medians, and upper quartiles) are shown in Table 3.

Moran's indexes for the poverty rates for 1990 and 2000 are 0.39 and 0.37, respectively, reflecting high degrees of clustering of poverty rates. Figure 1 shows that the LISA analysis clearly identified three major clusters in Texas (the "Texas cluster"), Mississippi, Louisiana, and some parts of Alabama, Arkansas, and Georgia (the "Mississippi Delta cluster"), and east Kentucky, west side of West Virginia, and some counties in Tennessee (the "Northeast cluster"). These clusters were consistent between years.

The parameter estimates for education, health and hospital, parks and recreation, and public welfare expenditures are superimposed on the three major clusters of poverty in Figures 2 through 5 to visually highlight the spatial variations inside and outside the spatial clusters of poverty. Figure 2 shows the impact of per capita education expenditure on the poverty rate. In 1990, the highest marginal effects for education expenditure on alleviating poverty occurred in the Mississippi Delta and Northeast clusters. An increase of $100 per capita in education expenditure within the Mississippi Delta and the Northeast clusters decreased the respective poverty rates by 0.14% and 0.66% in 1990. The marginal effects of education expenditure on alleviating poverty declined in 2000 to 0.04% and 0.13% in the Mississippi Delta and Northeast clusters, respectively. The declining impact of education expenditure on poverty may result from the decreasing effect of education expenditure in counties that have experienced economic development over the decade because the rate of return on investment in education tends to be low in more developed counties (Psacharopoulos 1984).

Figure 3 shows the impacts of per capita health and hospital expenditure on poverty rates. In 1990, the highest marginal effect of per capita health and hospital expenditure on alleviating poverty occurred in the Texas cluster, where an increase of $100 in per capita health and hospital expenditure decreased the poverty rate by 0.46%. This marginal effect decreased to 0.03% in 2000. The declining impact of health and hospital expenditure in this cluster may result from the growth of managed care in Texas during the 1990s, while before 1990 Texas had relied more heavily on public hospitals for low income people (Wiener et al. 1997). Conversely, a positive marginal effect of per capita health and hospital expenditure on the alleviating poverty in the Northeast cluster did not exist in 1990, but it did exist in the West Virginia counties of the Northeast cluster in 2000. Average per capita health and hospital expenditure was $136 in those

counties in 2000, which was only 58% of the average for the entire study area. The improvement in the marginal effects of per capita health and hospital expenditure on alleviating poverty in those West Virginia implies that government expenditures for outpatient health services and support of public and private hospitals need to be increased.

Figure 4 shows the impacts of per capita parks and recreation expenditure on the poverty rate. The proportion of the study area over which this government expenditure category has positive effects increased between 1990 and 2000, but the average impact within the entire study area decreased. In 1990, an increase of $100 per capita parks and recreation expenditure decreased the poverty rate by 2.13% and 1.06% in the Texas and Mississippi Delta clusters, respectively. These marginal effects decreased in 2000 to 0.16% and 0.66%, respectively. A positive marginal effect of per capita parks and recreation expenditure on the alleviating poverty in the Northeast cluster did not exist in 1990 but positive impacts emerged in the eastern Kentucky counties within this cluster in 2000. Average per capita parks and recreation expenditure in these counties was $9 in 2000, which is less than half the study-area average. The increased marginal effects over the decade in these counties implies that government expenditures on recreational facilities, such as golf courses, parks and camping areas, can have an impact on reducing poverty by attracting tourists to stimulate the local economy (Hunter, Boardman, and Saint Onge 2005).

Figure 5 shows the impacts of per capita government welfare expenditure on poverty. Public welfare expenditure has poverty-reducing effects in the Texas cluster in 1990 and in lower Mississippi Delta cluster and several counties in the Northeast cluster in 2000. An increase of $100 in per capita public welfare expenditure decreased the poverty rate by 1.11% in the Texas cluster in 1990 and 0.30% and 0.09% in 2000 in the Mississippi Delta and Northeast clusters,

respectively. The areas of positive marginal effects of public welfare expenditure on the poverty rate are relatively small compared with the areas of positive effects of other government expenditure categories. This result could indicate that temporary assistance programs for needy persons, such as cash assistance and vendor payments, are less effective in reducing poverty in most areas on the South.

Finally, another way to illustrate spatial variation in the marginal effects of government expenditures on poverty is to compare the marginal effects on the poverty rate of different government expenditure categories. The results of these calculations are provided in Table 4. The average positive marginal effects for the counties in the three clusters for expenditures on education, health and hospital, parks and recreation, and public welfare decreased by 0.24%, 0.24%, 0.64%, and 0.96% respectively from the 1990 time period to the 2000 time period.

Conclusions

This research analyzed temporal and spatial variations in the effects of education, health and hospital, parks and recreation, and public welfare expenditures on alleviating poverty in the Southern United States. While the decreasing marginal effects were the trend for the overall study area, they increased between 1990 and 2000 in some regions. For example, the marginal effects of per capita health and hospital expenditure in the eastern Kentucky counties of the Northeast cluster were not significant in 1990 but were positive in 2000.

Using GWR regression results to estimate clusters of positive marginal effects, the government expenditure categories with the highest marginal effects on poverty alleviation in 1990 were parks and recreation expenditure in the Texas cluster, public welfare expenditure in the Mississippi Delta cluster, and parks and recreation expenditure in Northeast cluster. In 2000,

parks and recreation expenditure had the highest marginal effects on poverty reduction across all the three clusters.

Interestingly, the results suggest that parks and recreation expenditure has been the single most effective government expenditure category over time, although public welfare was most effective category in the Mississippi Delta cluster in 1990. Nevertheless, the marginal effects of government expenditures on poverty alleviation have generally weakened over time.

This study contributes to the growing literature on the effects of government expenditures on poverty alleviation in two important ways. First, using county data for the Southern United States, we examine how the effects on poverty of four categories government expenditures have changed over time and compare these changes among categories. The findings that the marginal effects of government expenditures on poverty alleviation have decreased over time and that parks and recreation expenditure had the highest marginal effects on poverty alleviation in each of the three main poverty clusters in the South have important policy implications for poverty reduction. Second, we use GWR and LISA clustering to analyze spatial variation in the effects of government expenditures on poverty rates across counties. This analysis includes the identification of poverty 'hot-spots' and an examination of the marginal effects of government expenditures on poverty alleviation in each of the identified poverty clusters. The implications drawn from the marginal effects of government expenditures on poverty alleviation will likely interest policymakers and planners as they make decisions about poverty reduction in the South.

References

Alesina, A., R. Baqir., and W. Easterly. 1999. "Public Goods and Ethnic Divisions." *Quarterly Journal of Economics* 114(4):1243–84.

Anselin, L. 1995. "Local Indicators of Spatial Association - LISA." *Geographical Analysis* 27: 93–115.

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

Beale, C.L. 2004. "Anatomy of nonmetro high poverty areas: Common in plight distinctive in nature." *Amber Waves* 2, Internet site: http://www.ers.usda/AmberWaves/AllIssues

Berthoud, R. 2002. "Poverty and prosperity among Britain's ethnic minorities." *Benefits* 10(1(33)): 3–8.

Calhoun S.D., R.J. Reeder., and F.S. Bagi. 2000. "Federal Funds in the Black Belt." *Rural America* 15:20–27.

Cho, S., S. Jung, and S. Kim. 2008. "Valuation of Spatial Configurations and Forest Types in the Southern Appalachian Highlands." *Environmental Management:* in press.

Cleveland W.S., and S.J. Devlin. 1988. "Locally Weighted Regression: An Approach to Regression Analysis by Local Fitting." *Journal of the American Statistical Association* 83: 596–610.

DeNavas-Walt, C., D.P. Bernadette., and J. Smith. 2007. *Income, Poverty, and Health Insurance Coverage in the United States: 2006 U.S. Census Bureau, Current Population Reports*. Washington DC: U.S. Government Printing Office, pp. 60–233.

Fan S., P. Hazell, and T. Haque. 2000. "Targeting public investments by agro-ecological zone to achieve growth and poverty alleviation goals in rural India." *Food Policy* 25: 411–428.

Fan, S., P. Hazell, and S. Thorat. 2000. "Government Spending, Growth and Poverty in Rural India." *American Journal of Agricultural Economics* 82 (4): 1038–51.

Fan, S., L. Zhang, and X. Zhang. 2002. "Growth and Poverty in Rural China: The Role of Public Investment." *International Food Policy Research Institute Policy Report* 125.

Fotheringham, A.S., and C. Brunsdon. 1999. "Local Forms of Spatial Analysis." *Geographical Analysis* 31: 340–58.

Fotheringham A.S., C. Brunsdon, and M.E. Charlton. 2002. *Geographically Weighted Regression: The Analysis of Spatially Varying Relationships*. John Wiley and Sons Ltd, West Sussex, England

Friedman, S., and D.T. Lichter. 1998. "Spatial inequality and poverty among African American children." *Population Research and Policy Review* 17:91–109.

Gomanee, K., S. Girma, O. Morrissey, and A. Verschoor. 2005. "Aid, Government Expenditure and Aggregate Welfare." *World Development* 33(3): 355–370.

Goodchild, M.F. 1986. *Spatial autocorrelation. CATMOG — Concepts and Techniques in Modern Geography* No. 47. Institute of British Geographers. Geo Books, Norwich, U.K.

Hunter, L.M., J.D. Boardman, and J.M. Saint Onge. 2005. "The Association Between Natural Amenities, Rural Population Growth, and Long-Term Residents' Economic Wellbeing." *Rural Sociology* 70(4): 452–469.

Jung, H., and E. Thorbecke. 2003. "The Impact of Public Education Expenditure on Human Capital, Growth, and Poverty in Tanzania and Zambia: a General Equilibrium Approach." *Journal of Policy Modeling* 25: 701–725.

Leung Y, C.L. Mei, and W.X. Zhang. 2000. "Testing for Spatial Autocorrelation among the Residuals of the Geographically Weighted Regression." *Environment and Planning A* 32(5): 871–890.

Levernier, W., M.D. Partridge, and D.S. Rickman, 2000. "The Causes of Regional Variation in U.S. Poverty: A Cross-County Analysis." *Journal of Regional Science* 40(3): 473–497.

Mauro, P. 1995. "Corruption and Growth." *The Quarterly Journal of Economics* 110: 681–712.

McMillen, D.P. 2004. "Employment Densities, Spatial Autocorrelation, and Subcenters in Large Metropolitan Areas." *Journal of Regional Science* 44(2): 225–244.

Montalvo, J.G., and M. Reynal-Querol. 2005. "Ethnic Diversity and Economic Development." *Journal of Development Economics* 76 (1):293–323.

Páez A, T. Uchida, and K. Miyamoto. 2002. "A General Framework for Estimation and Inference of Geographically Weighted Regression Models: 2. Spatial Association and Model Specification Tests." *Environment and Planning A* 34 (5): 883–904.

Psacharopoulos, G. 1984. The Contribution of Education to Economic Growth: International Comparisons. In *International Comparisons of Productivity and Causes of the Slowdown*, ed. J. W. Kendrick. Cambridge, Mass., U.S.A.: Ballinger Publishing Company.

Reeder, R.J., and S.J. Calhoun. 2002. "Federal Funds in Rural America: Payments Vary by Region and Type of County." *Rural America* 17(3): 1–3.

Rupasingha, A. and S.J. Goetz. 2007. "Social and Political Forces as Determinants of Poverty: A Spatial Analysis." *Journal of Socio-Economics* 36:650–671.

Swaminathan, H., and J. Findeis. 2004. "Policy intervention and poverty in rural America." *American Journal of Agricultural Economics* 86: 1289–96.

Swail, W.S., K.E. Redd, and L.W. Perna. 2003. "Retaining Minority Students in Higher Education: A Framework for Success." *ASHE-ERIC Higher Education Report* No. 2. Washington, DC: The George Washington University, School of Education and Human Development.

Triest, R.K. 1997. "Regional differences in family poverty." *New England Economic Review.* Pp. 3–17.

U.S. Census Bureau. 2006. Percentage of People in Poverty by State Using 2- and 3-Year Averages: 2004 to 2006. Internet site: http://www.census.gov/hhes/www/poverty/poverty06/state.html

Wiener, J.M., A. Evans, C. Kuntz, and M. Sulvetta. 1997. "Health Policy for Low-Income People in Texas." *Assessing the New Federalism State Report*. Washington, DC: The Urban Institute.

Williams, J.A. 2002. *Appalachia: A History*. University of North Carolina Press. 289–301.

Table 1. Average Poverty Rates by State in the Southern United States, 2004 to 2006

States	3 year average (2004-2006)
United States	12.5
Florida	11.4
Maryland	9.3
Delaware	9.2
Virginia	9.1
Mississippi	19.8
Louisiana	17.4
Kentucky	16.5
Texas	16.4
Alabama	16.0
Arkansas	15.6
Tennessee	15.2
West Virginia	15.0
Oklahoma	13.9
North Carolina	13.8
South Carolina	13.7
Georgia	13.3

Source: U.S. Census Bureau 2006.

Table 2. Variable Names, Descriptions, and Statistics

Variable	Description	1990 Mean (S.D)	2000 Mean (S.D)
Dependent Variable			
Individual poverty rate	Poverty rate of individual whose income is below poverty threshold by the U.S. Census Bureau, 1989 and 1999 in percent (%)	17.21 (7.40)	14.11 (5.95)
Demographic Variables			
Native American	Percentage of Native American over total population (%)	1.05 (3.41)	1.09 (3.29)
Asia – Pacific	Percentage of people from Asia – Pacific over total population (%)	0.35 (0.54)	0.54 (0.76)
Age 0-17 years	Percentage of persons 0-17 years of age over total population (%)	27.16 (3.22)	25.69 (2.91)
Age 18-24 years	Percentage of persons 18-24 years of age over total population (%)	9.77 (3.03)	9.29 (2.91)
Age 65 years and over	Percentage of persons 65 years or more over total population (%)	14.26 (3.86)	13.96 (3.44)
Female head	Percentage of female headed family with no husband present over total families (%)	15.26 (5.81)	17.33 (6.37)
English disability	Percentage of people who speak English none/not well age between 16 and 64 over total population (%)	1.37 (3.15)	2.09 (3.25)
Educational attainment	Percentage of people with some college or more over population of 25 years plus (%)	29.99 (9.64)	36.87 (9.94)
Workers	Percentage of family that has 3 or more workers over total families (%)	10.50 (2.65)	9.15 (2.07)
Economic and Structural Variables			
Unemployment rate	Percentage of unemployed workers in age 16 plus (%)	6.72 (3.04)	4.84 (1.63)
Inequality index	Mean family income/ Median family income	1.26 (0.37)	1.26 (0.09)
Agriculture	Percentage of agriculture, forestry, and fisheries employment over total employment (%)	6.62 (6.24)	4.78 (4.96)
Manufacturing	Percentage of manufacturing, mining, construction employment over total employment (%)	31.76 (10.22)	27.94 (8.42)
Transportation	Percentage of transportation, communications, and other public utility employment over total employment (%)	6.71 (2.11)	5.66 (1.82)

Trade	Percentage of wholesale and retail trade employment over total employment (%)	18.97 (3.42)	14.53 (2.35)
Finance and insurance	Percentage of finance, insurance, and real estate employment over total employment (%)	3.99 (1.48)	4.25 (1.54)
Arts	Percentage of arts class employment over total employment (%)	0.56 (0.32)	0.59 (0.34)
Urban influence code	Urban influence code in 1993 and 2003, ranges from 1 to 9 for 1993 and 1 to 12 for 2003, less number indicating more urbanized area	5.60 (2.57)	5.18 (3.19)
Government Expenditure Variables			
Education	Expenditure on schools, colleges, educational institutions, and educational programs between in 1987 for 1990; in 1997 for 2000, $/capita	612.37 (217.99)	1086.43 (532.78)
Health and hospital	Expenditure on health and hospitals in 1987 for 1990; in 1997 for 2000, $/capita	137.02 (185.90)	234.83 (357.62)
Parks and recreation	Expenditure on recreational and cultural-scientific facilities in 1987 for 1990; in 1997 for 2000, $/capita	11.53 (17.42)	19.27 (23.38)
Public welfare	Expenditure of assistance to needy people in 1987 for 1990; in 1997 for 2000, $/capita	8.37 (17.88)	21.97 (62.85)

The data are at the county level and for 1990 and 2000 unless indicated differently in the table.

Table 3. Summary of Parameter Estimates the GWR Poverty Regression Model (Dependent Variable = family poverty rate)

	1990			2000		
Variables	Low-quart	Median	Up-quart	Low-quart	Median	Up-quart
Intercept	-18.282	4.998	18.193	-3.874	2.328	8.049
Demographic Variables						
Native American	-0.079	0.046	0.187	-0.120	0.026	0.131
Asia – Pacific	-1.569	-0.989	-0.410	-0.565	-0.256	-0.091
Age 0-17 years	0.312	0.482	0.729	0.159	0.458	0.617
Age 18-24 years	0.414	0.554	0.740	0.421	0.509	0.570
Age 65 years and over	0.078	0.314	0.611	-0.032	0.175	0.373
Female head	0.489	0.551	0.636	0.349	0.385	0.473
English disability	-0.123	0.325	0.566	0.164	0.303	0.394
Educational attainment	-0.251	-0.189	-0.139	-0.237	-0.208	-0.169
Workers	-0.930	-0.687	-0.378	-0.832	-0.648	-0.508
Economic and Structural Variables						
Unemployment rate	0.173	0.260	0.350	0.331	0.453	0.606
Inequality index	1.291	2.008	2.991	1.929	5.419	8.749
Agriculture	0.089	0.198	0.362	0.052	0.104	0.192
Manufacturing	-0.215	-0.151	-0.096	-0.195	-0.131	-0.090
Transportation	-0.223	-0.086	0.018	-0.237	-0.147	-0.041
Trade	-0.235	-0.098	0.055	-0.115	-0.067	0.011
Finance and insurance	-0.492	-0.121	0.057	-0.239	-0.161	-0.082
Arts	-0.849	-0.138	1.001	-0.445	-0.138	0.215
Urban influence code	0.041	0.188	0.319	0.046	0.130	0.172
Government Expenditure Variables						
Education	-0.001	0.001	0.002	-0.000	-0.000	0.002
Health and hospital	-0.001	-0.000	0.001	-0.000	-0.000	0.000
Parks and recreation	-0.006	0.009	0.024	-0.004	-0.001	0.003
Public welfare	-0.008	0.010	0.032	-0.002	0.001	0.003

*Number of observations is 1094 for 1990 and 2000. ***, ** and * indicate significance at the1%, 5% and 10% levels, respectively.*

Table 4. Percentage Change in the Poverty Rate from an Increase of $100 per capita Government Expenditure

	1990			2000		
	Texas	Mississippi	Northeast	Texas	Mississippi	Northeast
Education	0	0.144	0.658	0.033	0.042	0.135
Health and Hospital	0.456	0.105	0.015	0.026	0.031	0.026
Parks and Recreation	2.133	1.060	1.207	0.157	0.665	0.527
Public Welfare	1.107	1.736	0.220	0.066	0.003	0.087

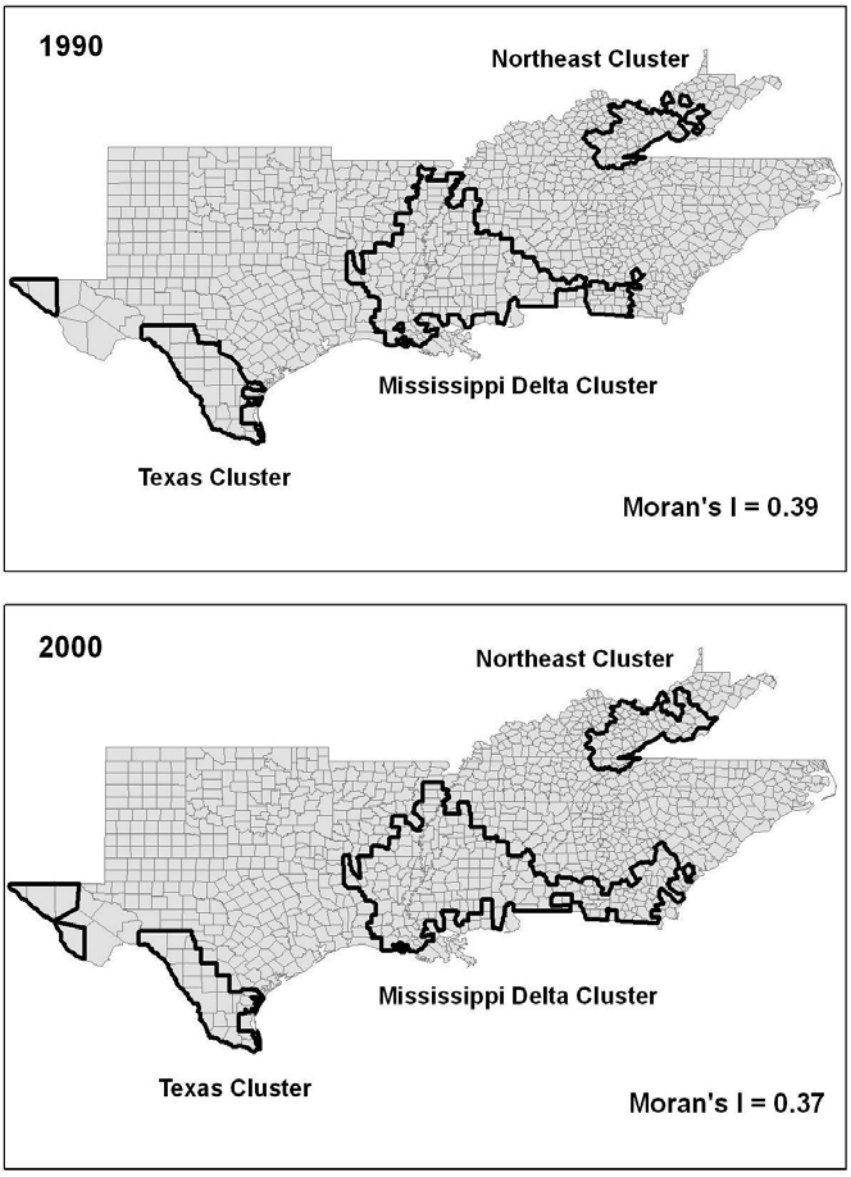
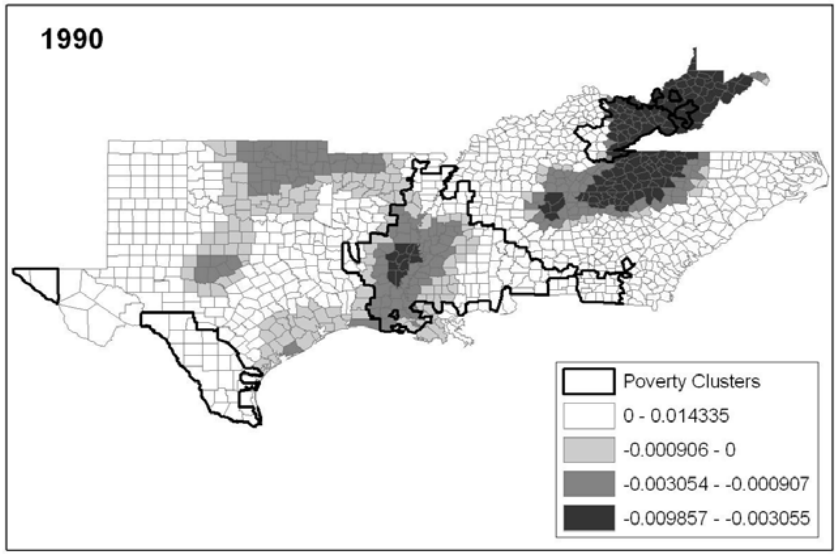


Figure 1. LISA clusters of poverty rate in 1990 and 2000



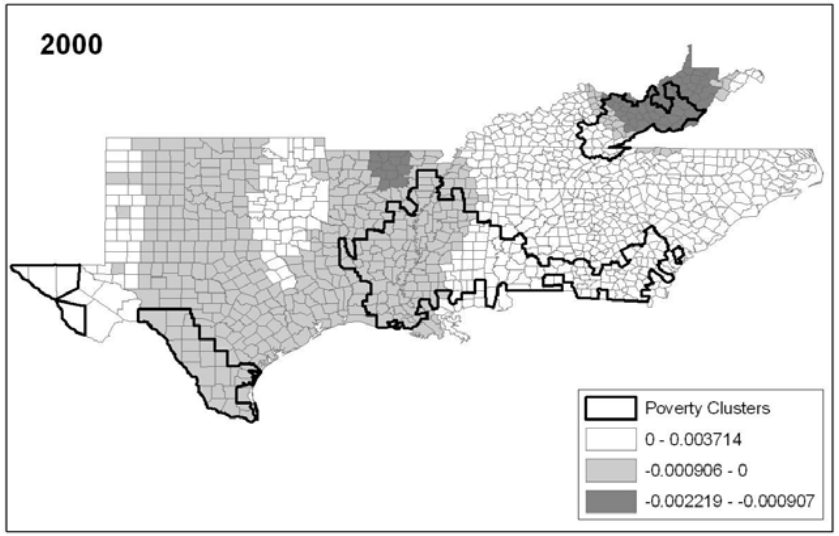
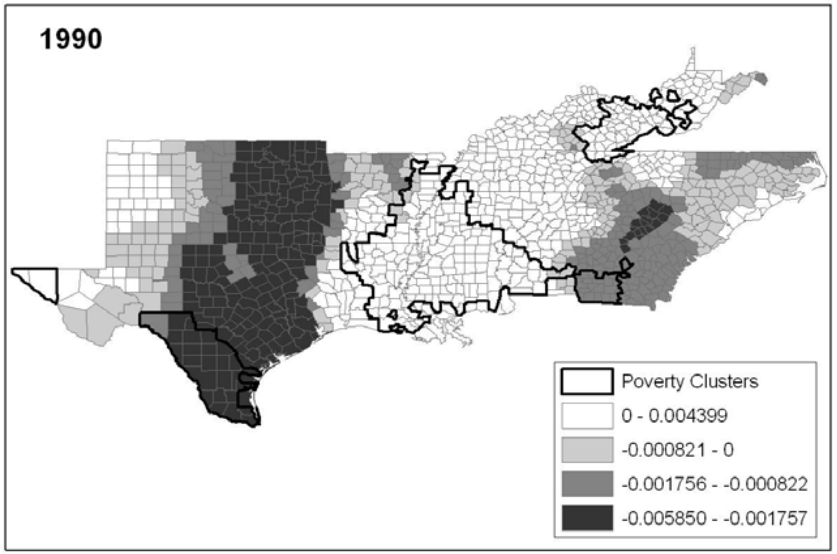


Figure 2. The impact of per capita education expenditure on poverty rate in 1990 and 2000 (Regions with dark solid lines denote counties with high poverty rates with similar high poverty neighbors.)



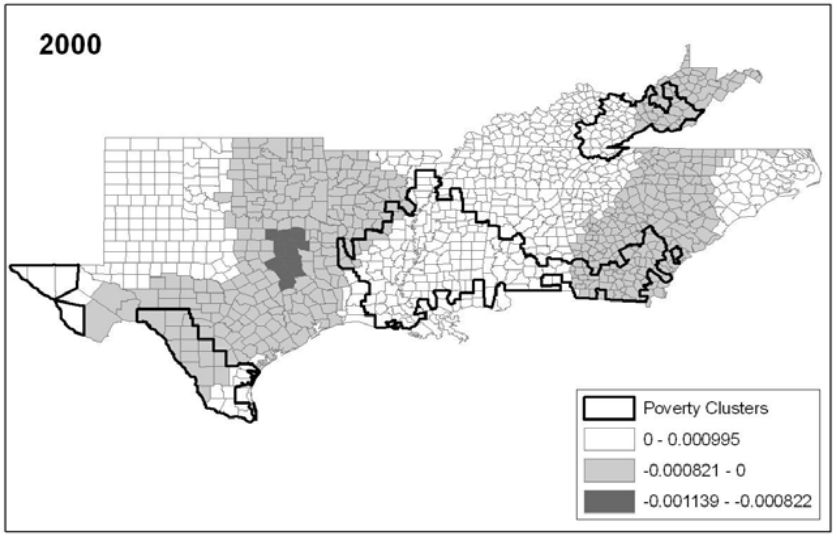
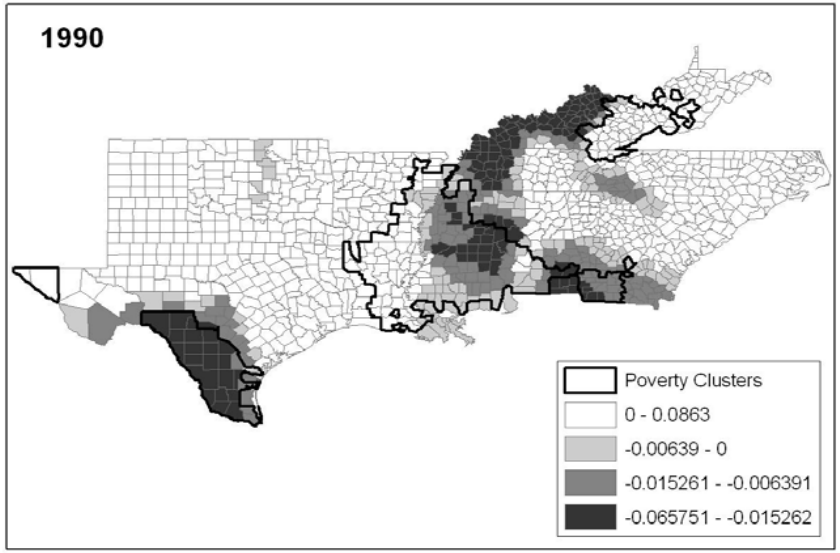


Figure 3. The impact of per capita health and hospital expenditure on poverty rate in 1990 and 2000 (Regions with dark solid lines denote counties with high poverty rates with similar high poverty neighbors.)



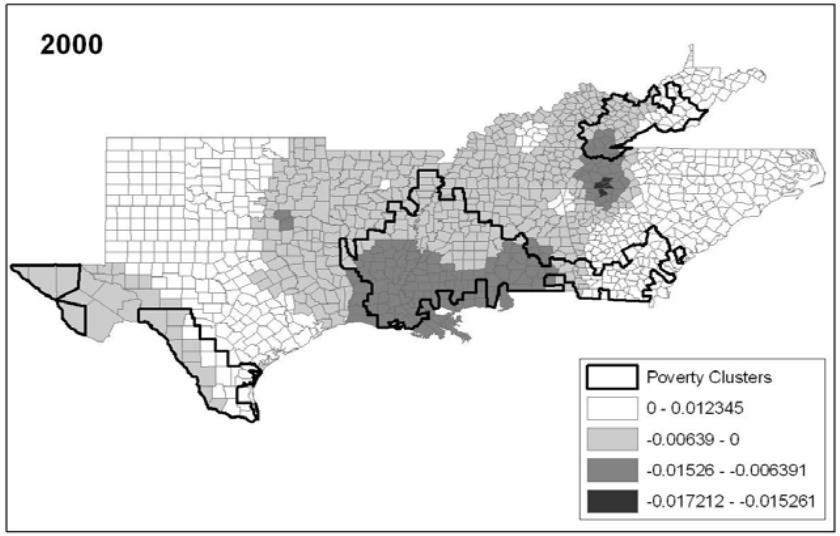
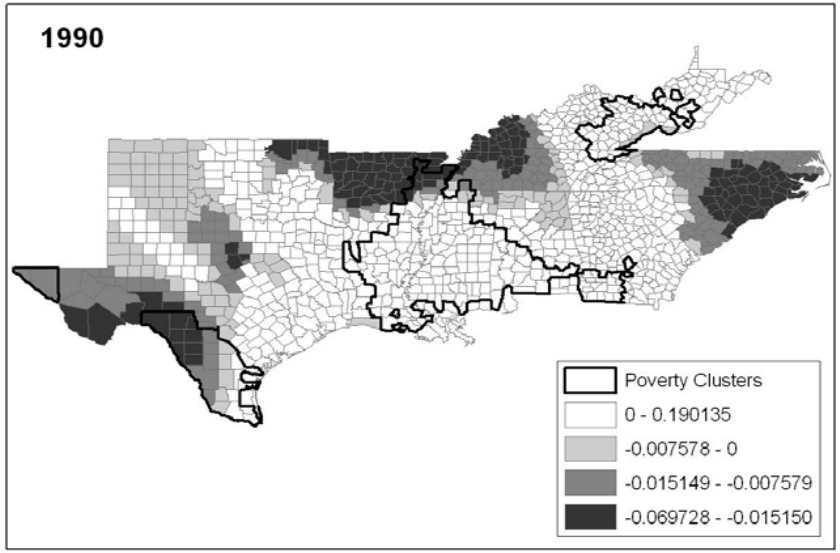


Figure 4. The impact of per capita parks and recreation expenditure on poverty rate in 1990 and 2000 (Regions with dark solid lines denote counties with high poverty rates with similar high poverty neighbors.)



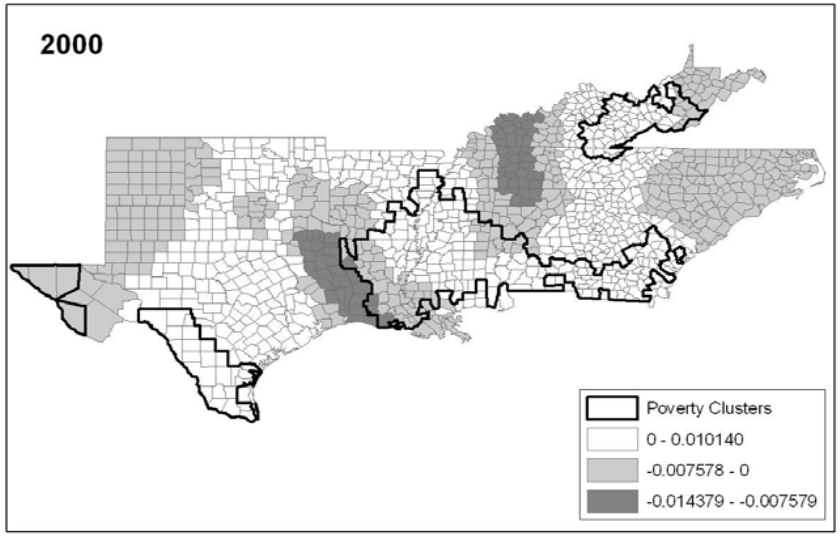


Figure 5. The impact of per capita public welfare expenditure on poverty rate in 1990 and 2000 (Regions with dark solid lines denote counties with high poverty rates with similar high poverty neighbors.)