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Understanding the Poverty U-turn Across Geographic Scales in the American Midwest, 1980-2010

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Abstract. This analysis seeks to understand the socioeconomic correlates of the poverty U-turn across time periods and geographic scales. Demographic and economic factors affecting poverty and its change from 1980-2010 are analyzed using spatial regressions across block-groups, census tracts, and counties in the North Central Region – West. Meso-level aggregations tend to undercount poor persons and places. Demographic effects on poverty are stable across geographic scale and time, but economic effects vary considerably. Single-headed families, high school non-completers, minorities, and college students are associated with higher local poverty. Industrial and agricultural employment is associated with better poverty outcomes in 1980, but in 2000 it results in worse outcomes or no effect. Lower-skilled services employment in 2000 is linked to higher poverty, but it has no effect in 1980. Higher-skilled services jobs has no effect on poverty in 2000 but a beneficial effect in 1980. Results suggest the poverty U-turn is only partially driven by economic restructuring in the region.

1. Introduction

There is increasing evidence that the United States and the American Midwest is experiencing a "Great U-Turn" in inequality and poverty (Moller, Alderson and Nielsen, 2009; Nielsen and Alderson, 1997 and 2001). An expanding post-war economy and Great Society programs resulted in large drops in poverty on aggregate. Despite short setbacks in the 1980s due to recessions and Farm Crises where poverty rates spiked, the booming economy of the 1990s continued this trend of declining yet concentrated deprivation. However, the recessions of the 2000s have reversed this trend and increased poverty for many, but not all, areas of the United States (DeNavas-Walt, Proctor, and Smith, 2011). As a result social scientists have begun to analyze the causes of rising poverty over time and its relative concentration across space. The bulk of this work has focused on county-level analyses (Curtis, Voss, and Long, 2012). However, only a limited number of studies have been conducted at sub-county level geographies, and almost none compare effects across these small-scale areas (Lobao and Hooks, 2007; Peters, 2009 and 2011; Wheeler and La Jeunesse, 2008).

There is a need to better understand the dynamics of poverty across time and space to document correlates of the "Great U-Turn" and whether the effects are constant across geographic scales. Previous research has clearly demonstrated that poverty persists in the United States across regions over time (Lobao, 2004; Lobao and Saenz, 2002; Partridge and Rickman, 2005; Weber, Jensen, Miller, Mosley, and Fisher, 2005). This body of work has demonstrated that poverty can be explained by differences in economic structures, individuals, natural resources, geography, and past history. The poverty and inequality literatures have studied these dynamics at smaller sub-county geographies, but they have typically been at a single geographic scale (Crandall and Weber, 2004; Nizalov and Schmid, 2008; Peters, 2009 and 2011; Wheeler and La Jeunesse, 2008). There is

scant previous research comparing effects across multiple geographic scales over time.

Understanding the dynamics of poverty across geographies is important because empirical results may differ when the same data are aggregated across different scales, termed the Modifiable Areal Unit Problem or MAUP (Chi and Zhu, 2008). From a research perceptive, understanding that the poverty literature may arrive at different conclusions based primarily on the choice of geography emphasizes the need to explicitly consider the spatial scale in poverty research. From a policy perspective, different findings from the research suggest different policy responses depending on the geographic scale in which they will be implemented. There is a need to better understand these scale differences in the poverty literature.

The purpose of this analysis is to understand the demographic and economic correlates of poverty across micro- and meso-scale geographies in the Midwestern United States, both currently and over the past 30 years. The first objective is to identify demographic and economic factors in 1980 and 2000 that affect current rates of poverty and its change. The second objective compares the effects of these correlates across micro- and meso-scale geographies to better understand how the MAUP may affect poverty research. The third objective seeks to understand how one feature of the Great U-Turn, a shift from an industrial to postindustrial employment base, either reduces (professionalization thesis) or increases (polarization thesis) poverty. This analysis is unique in terms of approach, examining the correlates of the Great U-turn of rising poverty and whether the effects are different across geographic scales and time. It is unique in terms of space, using sub-county level Census block groups and tracts to approximate micro-scale places to prevent potential aggregation errors in the analysis. It is unique in terms of time, using Census data from 1980, 2000, and 2010 to offer a long-term yet current look at poverty trends.

One weakness of this analysis is that the geographic scope is limited to the seven states of the western part of the North Central Region (NCR-W). The main reason for this limited scope is the labor-intensive task of recalculating past Census data to conform to current micro-scale geographic boundaries, especially at the block group level. However, the results can be of use in understanding regional poverty more broadly, since the region contains a diverse array of physical and socioeconomic conditions that are of interest to regional scientists studying rural development. The region has sparsely populated areas in decline, yet also contains large metropolitan areas that are rapidly suburbanizing. It has large-scale intensive agricultural production, but is also dominated by owner-operated farms and ranches. Parts of the region are strongly tied to the industrial economy, while other parts are strongly tied to the services economy. It is also becoming more ethnically diverse in both urban and rural areas, and it has pockets of natural amenities. Although the base rate of poverty is lower in the NCR-W than it is nationally, rates of change are generally similar. The poverty U-turn is also evident in the region as rates dropped from 11 percent in 1980 to just below 10 percent by 2000 before poverty rose to over 13 percent by 2010.

2. Previous research on poverty

A number of studies have demonstrated that place matters in understanding poverty, and a comprehensive review of this work is presented by Weber et al. (2005). The majority of these studies take a labor market approach to understanding poverty, which incorporates both individual and structural approaches within a spatial context (Cotter, 2002; Lobao, Hooks, and Tickamyer, 2007). These studies generally attempt to understand county-level poverty in terms of demographic characteristics, family structure components, geographic locations, industrial compositions, and a host of other labor market factors (Crandall and Weber, 2004; Curtis et al., 2012; Levernier, Partridge, and Rickman, 2000; Moller, Bradley, Huber, Nielsen, and Stephens, 2003; Partridge and Rickman, 2006 and 2007). A review of this work is presented below.

In terms of geography most studies of poverty use counties as the unit of analysis (Partridge and Rickman, 2006). In many ways, counties are ideal units for studying poverty because their boundaries are relatively stable over time, there is a wide array of data available, and they are an appropriate "meso" unit between neighborhoods and states (Curtis et al., 2012; Lobao, 2004). However, recent work has emphasized the need for more sub-county analyses to see if the relationships between poverty and various socioeconomic factors hold across geographic scales (Lobao and Hooks, 2007; Irwin, 2007). Analysis of poverty at a single small-scale geography is fairly well documented in the literature, specifically looking at poverty across block groups (Nizalov and Schmid, 2008), minor civil divisions (Peters, 2009), and census tracts (Crandall and Weber, 2004;

Jargowsky, 2003). The literature concludes that larger geographic scales result in aggregation errors that make high poverty neighborhoods statistically invisible. However, few studies specifically compare the effects of poverty correlates across multiple geographic scales. Current poverty research fails to answer the question of whether analyses at different geographic scales produces different results, as suggested by the Modifiable Areal Unit Problem (Chi and Zhu, 2008).

However, it is unclear whether economic factors are best modeled at the micro scale when examining poverty. Regional economics has studied the spatial relationship between poor neighborhoods and proximity to wealthy adjacent areas and has found two contradictory effects (Blair and Carroll, 2009). The spread effect is where development in adjacent prosperous areas spreads into lagging neighborhoods. By contrast, the backwash effect is where development in prosperous adjacent areas causes lagging neighborhoods to fall further behind. Therefore, it may not be employment opportunities in the immediate area that matter as much as opportunities in adjacent areas.

In terms of demographic structure, the literature unanimously supports the finding that higher levels of educational attainment, especially high school and Associate's degrees, reduce poverty. A strong relationship is also found between greater numbers of single-headed families with children and high local poverty, especially among those headed by females (Curtis et al., 2012; Moller et al., 2003). The impact minority populations have on poverty is less clear in the literature. Most studies show that larger populations of non-African-American minorities tend to increase local poverty (Slack, Singelmann, Fontenot, Poston, Saenz, and Siordia, 2009). However, the findings for African-American populations are mixed. National-scale studies show that African-American populations are associated with lower rates of poverty (Levernier et al., 2000), while nonmetropolitan studies show increases in poverty (Partridge and Rickman, 2006). Most analyses also look at age structure and generally find that younger persons (under age 24) tend to increase local poverty, while older persons (over age 64) tend to reduce poverty. Increased labor mobility across international borders has also been identified as a potential cause of increasing poverty (Alderson and Nielsen, 2002; Slack et al., 2009).

In terms of economic conditions, one of the strongest findings is that current poverty is highly dependent on previous poverty, indicating that poverty is persistent over time and place (Peters, 2009). The majority of studies show that increases in labor force participation rates lead to lower poverty rates at the county level, especially for women. As one would expect, the literature also shows that higher unemployment rates lead to higher local poverty, and this effect is particularly strong for male unemployment. Several analyses include employment growth and industrial restructuring in their models explaining poverty (Crandall and Weber, 2004; Curtis et al., 2012; Levernier et al., 2000; Partridge and Rickman, 2005 and 2007; Swaminathan and Findes, 2004). The findings demonstrate that employment growth strongly reduces local poverty, especially when counties are near metropolitan areas. Counties experiencing industrial restructuring are more likely to have higher poverty, as are counties with a less diversified employment base (Lobao, Jeanty, Partridge, and Kraybill, 2012).

A number of studies include industry employment variables to model local economic structure (Crandall and Weber, 2004; Curtis et al., 2012; Peters, 2009). The findings show that employment in traditional industrial sectors, such as manufacturing, tends to reduce local poverty. It is argued that these industries, owing to their history of unionization, offer better wages and benefits that reduce poverty. Employment in communications, health, and professional services is also found to be associated with lower rates of poverty. These higher-skill industries tend to pay higher wages and better benefits. By contrast, the literature also shows that employment in agriculture, trade, business services, and personal services increases local poverty. Since these industries tend to rely on more part-time or temporary labor arrangements, often for lower pay, it is argued that they result in higher poverty.

Conceptually, the link between poverty and economic structure in advanced capitalist democracies is predicated on the shift away from an industrial economy to a postindustrial one (Alderson and Nielsen, 2002; Bell, 1973). Termed the Great U-turn, this body of work argues that poverty rates fell through the postwar period as industrial-based welfare capitalism developed. However, beginning in the 1980s this system began to unravel due to globalization, deregulation, and services-based neoliberal capitalism. As a result, poverty began to rise with the emergence of a new services-based postindustrial economy. There is debate in the literature as to whether this economic shift either improves or worsens incomes, and views have generally coalesced into two distinct yet opposing theses. The

professionalization thesis argues that postindustrial sectors have reduced poverty by greatly expanding skilled middle-wage jobs and reducing unskilled lower-wage ones (Lash and Urry, 1994). The growing importance of technical and professional knowledge in all economic sectors has led to increased incomes and economic expansion through innovation. By contrast, the polarization thesis argues that the postindustrial economy has increased poverty (Hamnett, 2003; Sassen, 1991). This view acknowledges that the postindustrial economy has increased incomes, but it also argues that it has been paralleled by growth in relatively lower-skilled and lower-wage services jobs that have increased poverty.

3. Data and methods

In order to better understand how demographic and economic factors impact micro- and meso-scale poverty over time, the analysis uses a unique set of spatial data from the 1980 and 2000 Decennial Censuses and the 2006-2010 American Community Survey (ACS). Although ACS data are not point-in-time estimates, they are the only source of poverty data at the sub-county level. The ACS has replaced the long-form Decennial Census and there are some important differences between the two that should be noted. First, ACS data represent average values for each year between 2006-2010, rather than point-in-time estimates. Second, income and employment status are for the previous 12 month period, rather than for the previous calendar year. Third, standard errors for the ACS tend to be higher for smaller geographies than was the case in previous census periods using the long form. However, analysis of standard errors finds most estimates have coefficients of variation under 50 percent (with a large share under 35 percent), indicating fair data quality.

The units of analysis are Census block groups, tracts, and counties in the western part of the North Central Region (NCR-W), which consists of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. Block groups and tracts are delineated by local partners in cooperation with the Census Bureau and tend to represent distinct places or neighborhoods. Geographies with missing data or large standard errors (coefficient of variation exceeding 50%) in any time period are dropped from the analysis, including 231 block-groups, 173 tracts, and no counties. This results in 16,197 block-groups, 5,112 tracts, and 618 counties for analysis.

Block group and tract geographies change with each Decennial Census, and the data in this analysis are geographically adjusted to the 2010 Census geographies to permit valid comparisons over time. Data for 1980 are adjusted using a proprietary method by GeoLytics which employs Census GIS files and population counts at the block level to approximate 2000 geographies. Next, the data are adjusted to the 2010 geographies using the small-area relationship files from the Census Bureau. However, in a small number of instances (n =19) no acceptable match is found across years at the block-group level, which necessitates subjective approximations based on knowledge of the region.[1] This is not expected to influence the results since the number of block groups affected is small (one-tenth of a percent).

To achieve the analysis objectives, spatial regressions, specifically lattice data analyses, are used to predict poverty rates and change over time taking into account demographic and economic factors identified in the literature. Spatial regression is used to control for dependence in the residuals caused by the spatial nature of the data; failure to control for this dependence may lead to unreliable tests of model parameters (Anselin, 1988; LeSage and Pace, 2009). The spatial lag and spatial error models are presented in equations 1 and 2, where $\mathbf{y}$ is the dependent variable vector of poverty rates and change over time, $\mathbf{X}$ is a matrix of demographic and economic predictors, $\mathbf{W}$ is a matrix of spatial weights measuring connectivity between geographies using k-nearest neighbors contiguity, $\boldsymbol{\beta}$ is a vector of regression parameters, $\boldsymbol{\rho}$ is a vector of spatial autocorrelation parameters, $\boldsymbol{\upsilon}$ is a vector of spatial component residuals, and $\boldsymbol{\varepsilon}$ is a vector of spatially uncorrelated residuals. To correct for unknown fixed state effects, dichotomous variables for each state (excluding Iowa) are included to control for state factors affecting poverty rates.

$$\mathbf{Y} = \mathbf{X\beta} + \boldsymbol{\rho}\mathbf{Wy} + \boldsymbol{\varepsilon} \quad (1)$$

$$\mathbf{y} = \mathbf{X\beta} + \mathbf{u}, \ \textit{where}\ \mathbf{u} = \boldsymbol{\rho}\mathbf{Wu} + \boldsymbol{\varepsilon} \quad (2)$$

There is little theory guiding the selection of appropriate weights in spatial lattice data analysis, with most previous research comparing different weights until a defensible one is selected (Chi and

[1] Matches are found for nearly all block groups based on the Census relationship files. Block groups not matched include eleven in Dubuque County, Iowa, and eight in Murray County, Minnesota. These areas are subjectively matched to 2010 boundaries based on knowledge of the region.

Zhu 2008). Rook and Queen's contiguity weights are popular in the social sciences, but they are affected by poor data quality that creates geographic "islands" when data are missing or unreliable – which is the case in this analysis. Distance weights are also problematic because there is no clear guide on an appropriate distance, which may create too many neighbors in urban areas and too few in rural ones. This analysis follows the advice of Chi and Zhu (2008) that recommends using weights based on *k*-nearest neighbors, which addresses the two issues identified above. Using their guidelines as a starting point, initial spatial regressions are run to identify the number of neighbors that maximize spatial dependence at each geographic level. This exploratory approach indicates the optimal nearest neighbors for block groups is $k = 7$, for tracts $k = 5$, and for counties $k = 3$. These spatial weights are used in the analysis.

The three dependent variables are poverty in 2010, change in poverty between 1980 and 2010, and change between 2000 and 2010[2]. Independent variables are time-lagged to 1980 or 2000 values to reduce endogeneity with the dependent variables. However, this rather simple approach does not eliminate endogeneity, and it may still be present in the models. Independent variables are selected based on the poverty literature presented earlier that follows Weber et al. (2005). Demographic predictors for 1980 and 2000 include population (in thousands), population density per square mile (in thousands), minority population (percentage of the population that is non-white or Hispanic), single-headed families, educational attainment for the population aged 25 years and older, population enrolled in college or postsecondary institutions, and population age 65 years and older.

Economic predictors for 1980 and 2000 include poverty rate, labor force participation, and employment percentages in various industries for the population 16 years and older by place of residence. Industries are grouped to permit fairly accurate comparisons over time, since industry classification systems changed between 1980 (SIC) and 2000 (NAICS). Most industry descriptions are self-explanatory except for one. The leisure, personal, and retail services industry includes hotels and lodgings, eating and drinking places, entertainment and recreation establishments, businesses providing personal services, and retail stores. However, simply modeling local conditions fails to capture spread and backwash effects from adjacent areas (Blair and Carroll, 2009). To understand how adjacent economic conditions affect local poverty, the economic predictors for both local and adjacent areas are calculated according to the appropriate spatial weights.

Inspection of zero-order correlations ($r < 0.05$) and tolerance statistics ($1–SMC > 0.3$) indicates no extreme multicollinearity, although values are high between minority and single-headed family populations and between labor force participation and high school non-completers. In addition, the state fixed effect dichotomous variables are also significant across the models, indicating differences between states partially accounts for observed differences in micro and meso scale poverty. Multi-level models can be used in future analyses to understand why state differences exist.

One issue with comparing models with different sample sizes is differences in statistical power. As sample size increases the standard errors of the parameters become smaller, making them more likely to be statistically significant and increasing Type-I error. Since this analysis compares effects ranging from block-groups (n = 16,197) to counties (n = 618), it is important to make sure differences are due to geographic scale and not sample size. To address this issue a form of bootstrap sampling is employed to estimate consistent standard errors across sample sizes (Chernick, 2008). Bootstrap standard errors are computed by drawing 5,000 simple random samples of 618 cases from the block-group and tract data and then estimating the spatial models for each of the bootstrap samples. The resulting standard errors for each parameter form a sampling distribution from which means and confidence intervals can be computed. The bootstrap standard errors permit one to assess the statistical significance of the parameters across geographic scales, controlling for excessive power due to large sample sizes.

4. Results

4.1. Spatial distribution of poverty

To understand the spatial distribution of poverty, micro- and meso-scale geographies are identified as either high-poverty or growing-poverty if their rates exceed one standard deviation above the NCR-W average. In general, the results show that smaller

[2] The population poverty rate indicates the percentage of non-institutionalized persons living in households whose before-tax incomes fall below the federal poverty threshold for a given household size. Thresholds are not adjusted for regional cost of living differences, except for Alaska and Hawaii. In 2010 the federal poverty threshold was $10,830 for a 1-person household and $22,050 for a 4-person household.

micro-scale geographies tend to count more people living in poor areas than do larger meso-scale counties. This suggests that using meso-level counties increases aggregation errors compared to using micro-scale block groups and tracts, thus making many poor places and people statistically invisible. Spatial scale needs to be explicitly considered in poverty research, as using different geographic units will likely present very different pictures of poverty in a region.

High poverty areas in 2010 (rates exceeding 18.70%) are presented in Figure 1. Using block groups reveals 20.8 percent of the NCR-W population living in poor areas, compared to 18.3 percent for tracts and 9.1 percent for counties. This is also found for growing poverty areas (growth exceeding 4.04%) between 2000 and 2010, where using block groups counts 32.2 percent living in such areas, compared to 29.0 percent for tracts and 8.1 percent for counties (refer to Figure 3). No differences in geographic scale are found for growing poverty areas between 1980 and 2010 (refer to Figure 2).

Looking at the population living in high poverty block groups and counties across states, Minnesota (15.4%) and Iowa (17.9%) have the smallest populations by block group, and Nebraska (1.1%) and Minnesota (1.6%) the smallest by county. By contrast, Missouri and Kansas have the highest populations living in poor areas by both block group (26.4% and 22.2%, respectively) and county (16.0 and 15.0%, respectively). Using different geographic scales undercounts the population living in poor areas. Comparing meso-scale counties to micro-scale block groups, the largest underestimates occur in Nebraska (1.1% vs. 20.9%), North Dakota (5.5% vs. 20.9%), and Minnesota (1.6% vs. 15.4%). Refer to Figure 1.

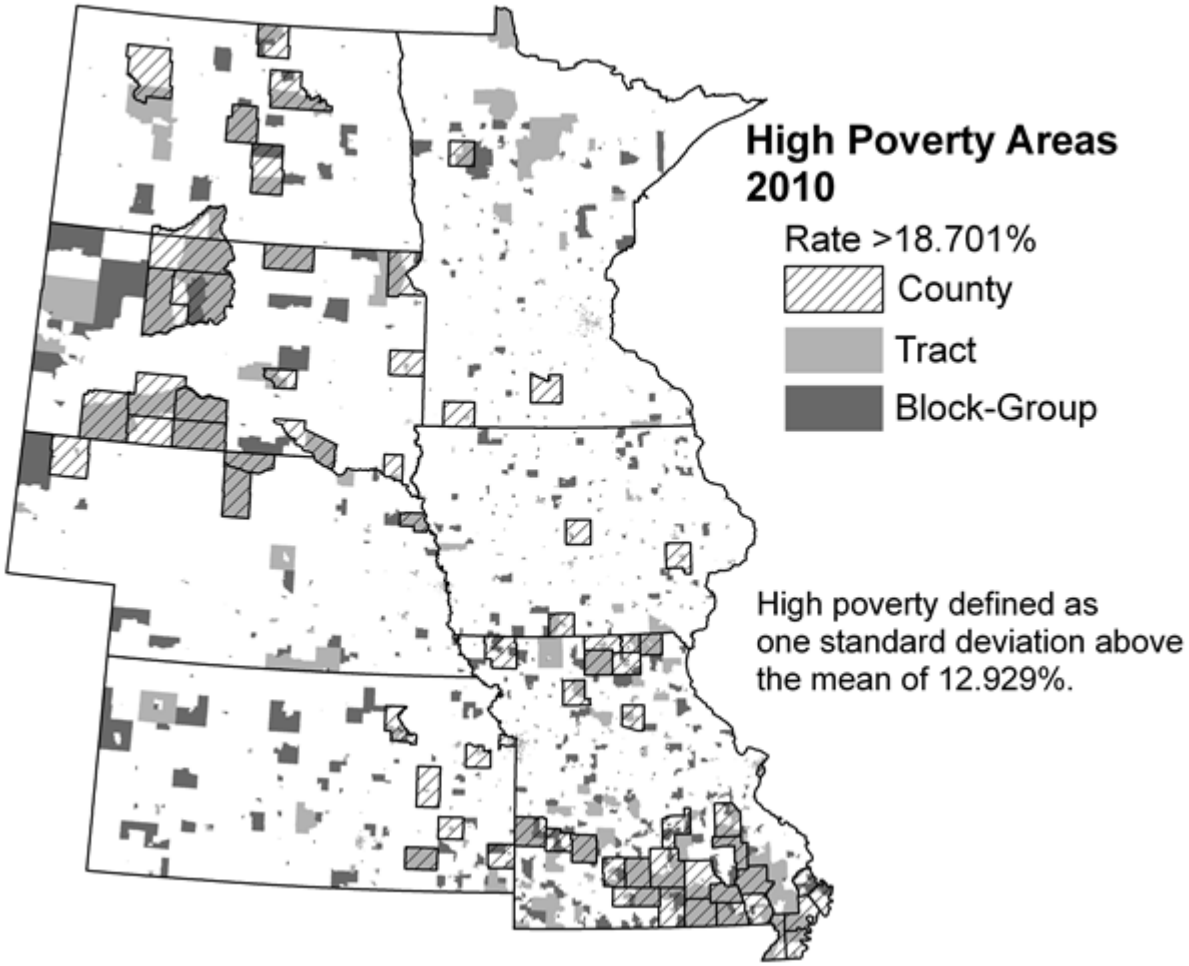

Figure 1. High poverty areas in 2010 for 16,197 block-groups, 5,112 census tracts, and 618 counties in the North Central Region.
Source: 2006-10 ACS, U.S. Census Bureau.

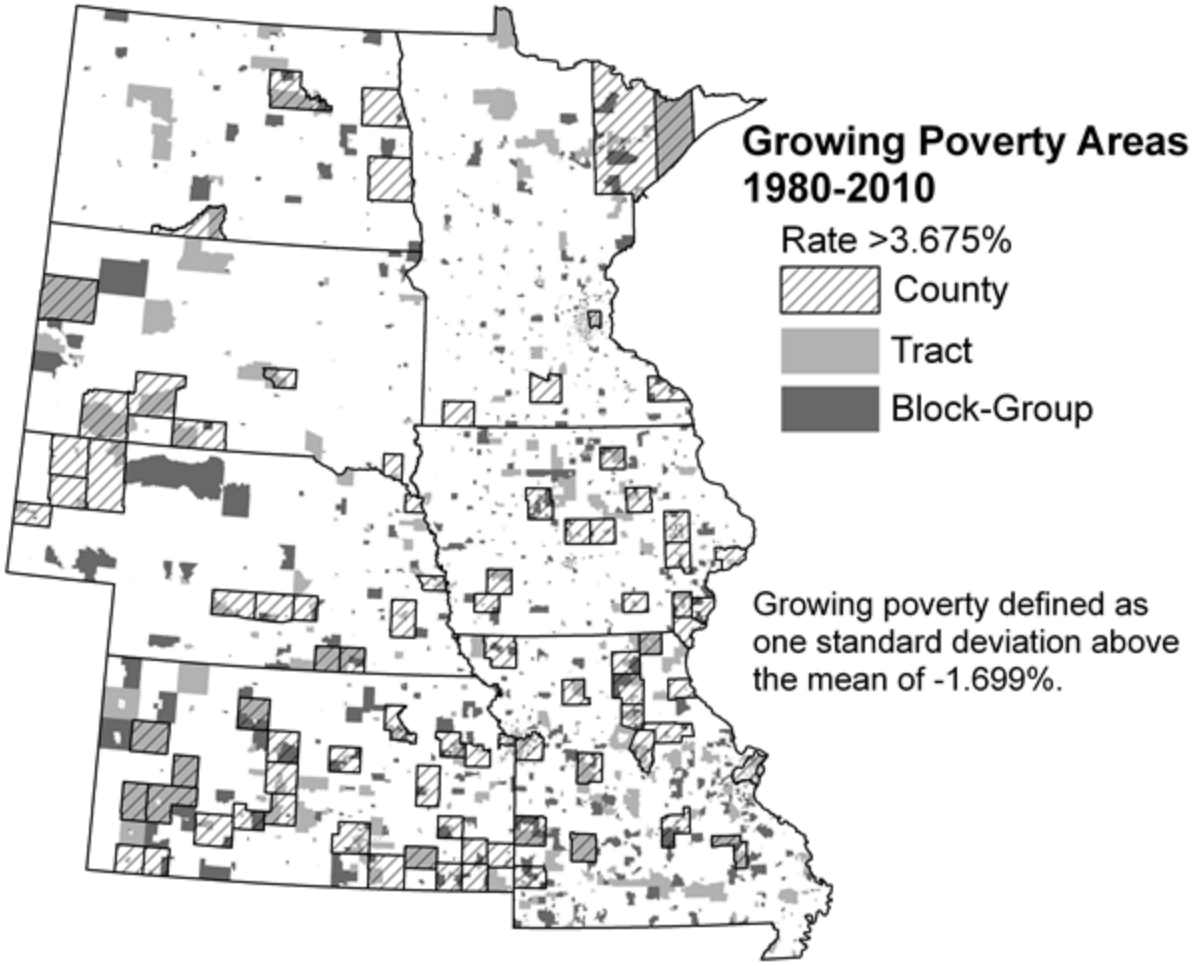

Figure 2. Growing poverty areas from 1980-2010 for 16,197 block-groups, 5,112 census tracts, and 618 counties in the North Central Region.
Source: 1980 Census and 2006-10 ACS, U.S. Census Bureau.

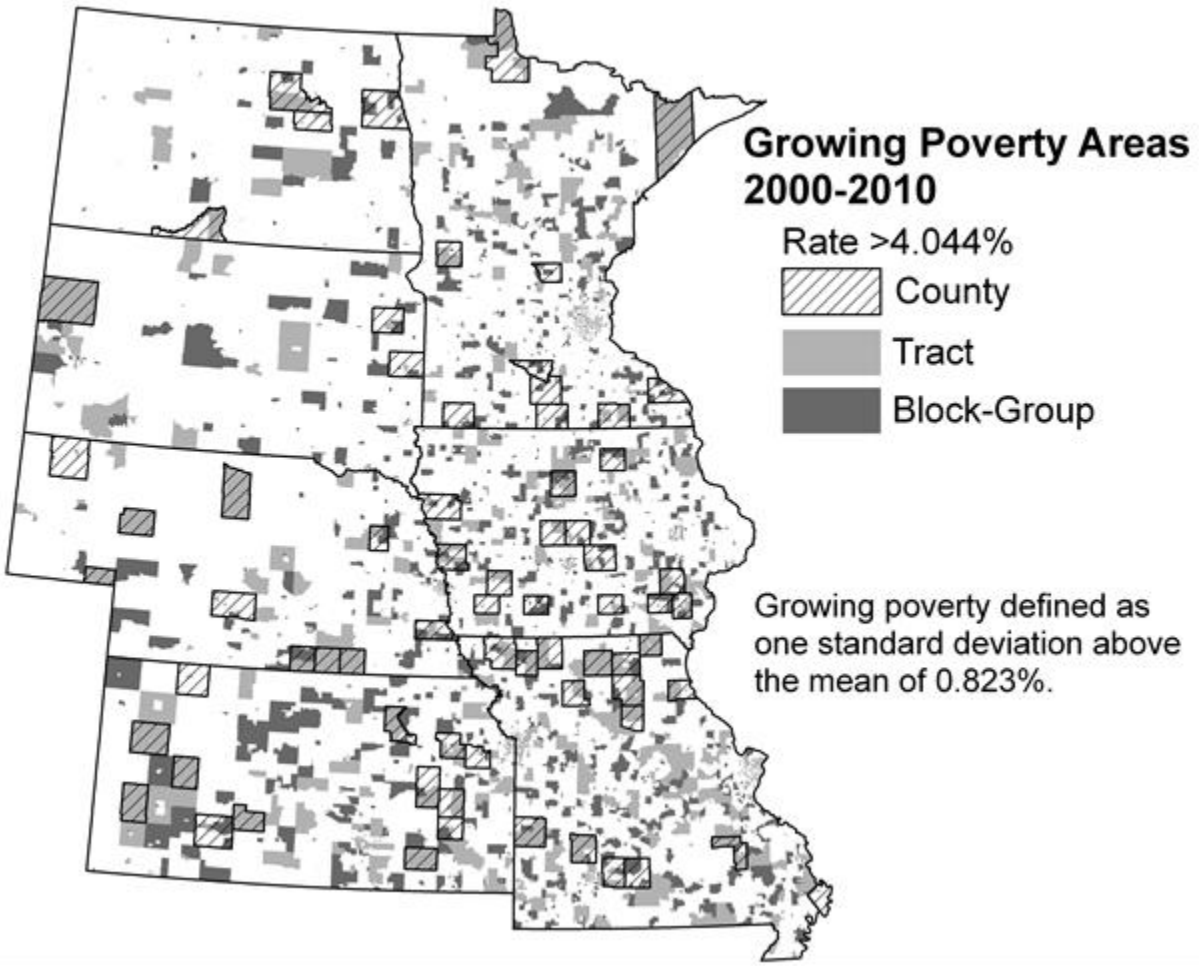

Figure 3. Growing poverty areas from 2000-2010 for 16,197 block-groups, 5,112 census tracts, and 618 counties in the North Central Region.
Source: 2000 Census and 2006-10 ACS, U.S. Census Bureau.

4.2. Spatial regression models of poverty 1980-2010

The results predicting poverty in 2010 and change over the last three decades using 1980 covariates is presented in Tables 1 and 2. The covariate model fitting poverty in 2010 reduces error variance over the intercept-only model by 39 percent for block groups ($pR^2 = 0.393$), 59 percent for tracts ($pR^2 = 0.593$), and 73 percent for counties ($pR^2 = 0.731$). For change in poverty between 1980 and 2010, the covariate model reduces error by 26 percent for block groups ($pR^2 = 0.256$), 39 percent for tracts ($pR^2 = 0.394$), and 59 percent counties ($pR^2 = 0.589$). Models using higher geographic aggregations tend towards better overall fit.

Results of the spatial regressions show that both poverty rates in 2010 (Table 1) and change in those rates between 1980 and 2010 (Table 2) are generally driven by similar demographic and economic effects across models and geographic scales. First looking at demographic factors in 1980, denser populations are strongly linked to higher and growing poverty at smaller geographies, but at the meso county-level the opposite effect of lower and declining poverty is observed. In addition, tracts and counties in metropolitan areas are linked with falling poverty rates. College student population, an important control variable often excluded from previous studies, is strongly associated with higher and growing local poverty. Larger percentages of single-headed families and high school non-completers are correlated with higher and growing rates of poverty across all geographic scales. Minority populations are also correlated with higher and growing poverty, but only at the county-level. Retiree populations age 65 and older are linked with worse outcomes,

increasing base poverty only at the meso scale and growing poverty at the micro scale. The results are consistent with the poverty literature conducted at the county level and demonstrate that these findings generally hold across smaller geographic scales.

In terms of general economic conditions, higher rates of poverty in 1980 are one of the strongest factors associated with higher poverty in 2010. This finding is consistent with the literature and suggests that high poverty is persistent and historically dependent across micro and meso scales. However, higher poverty 30 years ago tends to correlate with falling poverty rates over the same period, suggesting that persistently poor places do not have fast growing rates but tend to regress toward the mean. In short, previous poverty affects current rates and change differently and is likely driven by socioeconomic rather than geographic scale differences.

Next examining the effects of adjacent employment in 1980, the regressions show that industrial and agricultural economic sectors are associated with lower and falling poverty over the past 30 years, although the effects vary across geographic scales. Agriculture and natural resources are linked with better outcomes across all scales. Manufacturing and construction are only linked with falling poverty rates, and the effects are only present at higher-level aggregations. Most service sectors in 1980 have a minimal impact on current poverty, save for two cases. Employment in professional, education, and health services is associated with lower and falling rates, but this effect is only found at the county level and is absent at smaller scales. By comparison jobs in finance, insurance, and real estate have a local effect at smaller micro-scale geographies. The results are only partially consistent with previous research. While agriculture, industry, and higher-skill services are linked with better poverty outcomes, lower-skill services have no deleterious effect on poverty as posited.

Table 1. Spatial regressions of poverty rates in 2010 on local demographic and adjacent economic covariates in 1980 in the North Central Region.

	Block Groups	**Census Tracts**	**Counties**
	N=16,197	***N=5,112***	***N=618***
	Beta	*Beta*	*Beta*
y = Poverty Rate 2010	*(Std Err)*	*(Std Err)*	*(Std Err)*
Intercept	12.873**	15.352**	11.260
	(5.031)	*(7.046)*	*(9.613)*
Spatial lag (ρ)	n.a.	n.a.	n.a.
Spatial error (λ)	0.389**	0.470**	0.151**
	(0.013)	*(0.018)*	*(0.051)*
State fixed effects	Y	Y	Y
Local Demographics in 1980			
Metropolitan area	-1.007	-1.447*	-1.167**
	(0.962)	*(0.758)*	*(0.474)*
Micropolitan area	-0.455	-0.239	-0.356
	(0.910)	*(0.697)*	*(0.367)*
Population (1000s)	0.295	-0.170	0.000
	(0.568)	*(0.134)*	*(0.002)*
Population density (1000s / sq.mi.)	0.446**	0.575**	-1.817**
	(0.109)	*(0.104)*	*(0.491)*
Minorities (%)	0.001	0.031	0.340**
	(0.029)	*(0.021)*	*(0.028)*
Single-headed families (%)	0.164**	0.180**	0.308**
	(0.044)	*(0.031)*	*(0.051)*

Table 1 (continued)		**Block Groups**	**Census Tracts**	**Counties**
No high school degree (%)		0.141**	0.165**	0.065**
		(0.042)	*(0.032)*	*(0.030)*
College enrollment (%)		0.304**	0.324**	0.502**
		(0.059)	*(0.042)*	*(0.045)*
Age 65 and older (%)		0.067	0.074*	0.214**
		(0.056)	*(0.044)*	*(0.052)*
Local and Adjacent Economics in 1980				
Poverty (%)		0.560**	0.563**	0.291**
		(0.078)	*(0.062)*	*(0.063)*
Labor force participation (%)		0.030	0.057	-0.104
		(0.071)	*(0.054)*	*(0.074)*
Agriculture, natural resources (%)		-0.311**	-0.353**	-0.003
		(0.115)	*(0.088)*	*(0.092)*
Construction (%)		-0.295	-0.283*	-0.154
		(0.194)	*(0.156)*	*(0.153)*
Manufacturing (%)		-0.107	-0.129	0.000
		(0.111)	*(0.085)*	*(0.091)*
Transportation, communication, utilities (%)		-0.133	-0.167	0.011
		(0.152)	*(0.120)*	*(0.120)*
Wholesale trade (%)		-0.185	-0.176	-0.313*
		(0.186)	*(0.150)*	*(0.166)*
Leisure, personal, retail services (%)		-0.078	-0.134	-0.052
		(0.135)	*(0.105)*	*(0.116)*
Finance, insurance, real estate services (%)		-0.295	-0.308**	-0.036
		(0.188)	*(0.150)*	*(0.204)*
Business, repair services (%)		-0.299	-0.410*	-0.231
		(0.273)	*(0.228)*	*(0.346)*
Professional, education, health services (%)		-0.187	-0.218**	-0.262**
		(0.128)	*(0.099)*	*(0.113)*
Model Fit				
Akaike Information Criteria	*Null*	128959	38513	3924
	Covariate	121243	34244	3168
	χ^2_Δ	7716**	4269**	756**
Variance Components	*Null*	167.970	122.777	33.308
	Covariate	101.920	49.931	8.974
	PRE / pR²	0.393	0.593	0.731
Spatial Dependence (in OLS Model)				
Robust Lagrange Multiplier	*Lag*	3.846**	15.414**	0.003
	Error	167.739**	296.752**	3.082*
Moran's *I*		0.133**	0.220**	0.084**

Note: n.a. indicates coefficient not available. Significant at * $p<0.10$, ** $p<0.05$.
Spatial regressions and adjacent effects use nearest neighbor weights of k=7 for block-groups, k=5 for tracts, and k=3 for counties. Block-group and tract models employ Bootstrap standard errors. Source: 1980 Census and 2006-10 ACS, U.S. Census Bureau.

Table 2. Spatial regressions of change in poverty rates from 1980-2010 on local demographic and adjacent economic covariates in 1980 in the North Central Region.

	Block Groups	**Census Tracts**	**Counties**
	N=16,197	***N=5,112***	***N=618***
	Beta	*Beta*	*Beta*
y = Change in Poverty Rate 1980-2010	*(Std Err)*	*(Std Err)*	*(Std Err)*
Intercept	16.500**	22.812**	31.121**
	(5.168)	*(7.265)*	*(10.320)*
Spatial lag (ρ)	n.a.	n.a.	0.079*
			(0.045)
Spatial error (λ)	0.395**	0.473**	n.a.
	(0.013)	*(0.018)*	
State fixed effects	Y	Y	Y
Local Demographics in 1980			
Metropolitan area	-1.892*	-2.754**	-1.154**
	(0.981)	*(0.779)*	*(0.537)*
Micropolitan area	-1.207	-1.096	0.201
	(0.928)	*(0.717)*	*(0.422)*
Population (1000s)	0.227	-0.183	0.001
	(0.580)	*(0.138)*	*(0.003)*
Population density (1000s / sq.mi.)	0.491**	0.678**	-2.532**
	(0.111)	*(0.107)*	*(0.568)*
Minorities (%)	0.008	0.014	0.176**
	(0.029)	*(0.022)*	*(0.031)*
Single-headed families (%)	0.143**	0.154**	0.394**
	(0.045)	*(0.032)*	*(0.057)*
No high school degree (%)	0.105**	0.097**	0.015
	(0.043)	*(0.033)*	*(0.033)*
College enrollment (%)	0.250**	0.223**	0.349**
	(0.060)	*(0.043)*	*(0.052)*
Age 65 and older (%)	0.126**	0.131**	0.082
	(0.057)	*(0.045)*	*(0.057)*
Local and Adjacent Economics in 1980			
Poverty (%)	-0.628**	-0.634**	-0.805**
	(0.080)	*(0.064)*	*(0.070)*
Labor force participation (%)	-0.016	0.021	-0.076
	(0.073)	*(0.055)*	*(0.078)*
Agriculture, natural resources (%)	-0.347**	-0.426**	-0.220**
	(0.117)	*(0.091)*	*(0.098)*
Construction (%)	-0.296	-0.391**	-0.382**
	(0.198)	*(0.161)*	*(0.164)*
Manufacturing (%)	-0.103	-0.161*	-0.197**
	(0.113)	*(0.087)*	*(0.096)*

Table 2 (continued)		**Block Groups**	**Census Tracts**	**Counties**
Transportation, communication, utilities (%)		-0.119	-0.146	-0.186
		(0.155)	*(0.123)*	*(0.126)*
Wholesale trade (%)		-0.179	-0.301*	-0.501**
		(0.190)	*(0.154)*	*(0.178)*
Leisure, personal, retail services (%)		-0.033	-0.079	-0.127
		(0.138)	*(0.108)*	*(0.124)*
Finance, insurance, real estate services (%)		-0.419**	-0.513**	-0.335
		(0.191)	*(0.154)*	*(0.216)*
Business, repair services (%)		-0.300	-0.423*	-0.629*
		(0.278)	*(0.235)*	*(0.372)*
Professional, education, health services (%)		-0.112	-0.151	-0.367**
		(0.131)	*(0.102)*	*(0.121)*
Model Fit				
Akaike Information Criteria	*Null*	126287	36788	3835
	Covariate	121883	34531	3338
	χ^2_Δ	4404**	2258**	497**
Variance Components	*Null*	142.423	87.169	28.836
	Covariate	105.949	52.832	11.841
	PRE / pR²	0.256	0.394	0.589
Spatial Dependence (in OLS Model)				
Robust Lagrange Multiplier	*Lag*	13.473**	9.877**	8.287**
	Error	231.489**	171.007**	5.025**
Moran's *I*		0.130**	0.212**	0.011

Note: n.a. indicates coefficient not available. Significant at * $p<0.10$, ** $p<0.05$.
Spatial regressions and adjacent effects use nearest neighbor weights of k=7 for block-groups, k=5 for tracts, and k=3 for counties. Block-group and tract models employ Bootstrap standard errors. Source: 1980 Census and 2006-10 ACS, U.S. Census Bureau.

4.3. Spatial regression models of poverty 2000-2010

While the previous models examined poverty over the past 30 years, the last decade has seen remarkable economic change both in the United States and the American Midwest. The decade of the 2000s began at the height of a technology boom and finished at the tail-end of one of the worse recessions over the past half century. To gain a better understanding of how poverty was affected during this period, Tables 3 and 4 present the results predicting poverty in 2010 and change over the past 10 years using 2000 covariates. In terms of model fit, the covariate model fitting poverty in 2010 reduces error variance by 53 percent for block groups (pR^2 = 0.527), 74 percent for tracts (pR^2 = 0.742), and 79 percent for counties (pR^2 = 0.790). The covariate model estimating change in poverty between 2000 and 2010 fared much worse, reducing error by only eight percent for block-groups (pR^2 = 0.081), 14 percent for tracts (pR^2 = 0.140), and 38 percent counties (pR^2 = 0.384).

Demographic covariates in 2000 generally have the same effect on poverty as the 1980 covariates, save for some differences noted below. Metropolitan location and population densities in 2000 have no effect on current poverty or change within the last decade across all scales, counter to the 1980 model that finds strong effects. Minority populations in 2000 are associated with worse poverty outcomes at more micro-scale geographies, whereas the 1980 model finds effects only at the meso scale. Conversely, retiree populations in 2000 only have an effect on growing poverty rates at the meso scale, rather than at the micro scale as in 1980. Previous poverty rates in 2000 exert a strong influence on current poverty rates, with higher base rates correlating

with higher, yet falling, poverty over the last decade. This effect is consistent yet much stronger than in the 1980 model.

While demographic factors are generally consistent across the 1980 and 2000 models, the same cannot be said for the effects of adjacent economic structure. While in 1980 larger employment shares across most industries resulted in better poverty outcomes, in 2000 these same economic sectors resulted in either worse outcomes or had no effect on poverty. For the agricultural sector, larger employment shares in 2000 have no effect on poverty, even though in 1980 they are associated with lower and falling rates. Goods-producing jobs in 2000 tend to result in worse poverty outcomes. Employment in construction, manufacturing, transportation, communication, and utilities all have a positive effect on current poverty (but not rates of change) at the county level, whereas these same sectors in 1980 have no effect. Lower-skill services in 2000 also tend to result in worse outcomes, while higher-skill services have little effect on poverty. Jobs in leisure, personal, retail, business, and repair services have a positive effect on poverty rates and its change at the tract and county levels, but no effect is observed in the 1980 model. By contrast, employment in finance, insurance, real estate, professional, education, and health services has no effect on poverty and its change, whereas 1980 employment results in better outcomes. Taken together, the results clearly show that the effect of adjacent economic structure on poverty largely depends on time period differences, rather than on geographic differences.

Table 3. Spatial regressions of poverty rates in 2010 on local demographic and adjacent economic covariates in 2000 in the North Central Region.

	Block Groups	**Census Tracts**	**Counties**
	N=16,197	***N=5,112***	***N=618***
	Beta	*Beta*	*Beta*
y = Poverty Rate 2010	*(Std Err)*	*(Std Err)*	*(Std Err)*
Intercept	-9.706**	-8.852**	-17.878**
	(2.928)	*(3.395)*	*(8.169)*
Spatial lag (ρ)	n.a.	-0.100**	-0.181**
		(0.019)	*(0.042)*
Spatial error (λ)	0.099**	n.a.	n.a.
	(0.016)		
State fixed effects	Y	Y	Y
Local Demographics in 2000			
Metropolitan area	-0.724	-0.865	-0.575
	(0.962)	*(0.553)*	*(0.442)*
Micropolitan area	-1.039	-0.800	-0.406
	(0.910)	*(0.509)*	*(0.326)*
Population (1000s)	0.076	-0.078	0.000
	(0.568)	*(0.089)*	*(0.002)*
Population density (1000s / sq.mi.)	0.103	0.106	-0.643
	(0.109)	*(0.079)*	*(0.514)*
Minorities (%)	0.038	0.032**	0.094**
	(0.029)	*(0.014)*	*(0.022)*
Single-headed families (%)	0.177**	0.233**	0.418**
	(0.044)	*(0.028)*	*(0.061)*
No high school degree (%)	0.164**	0.182**	0.089**
	(0.042)	*(0.030)*	*(0.032)*

Table 3 (continued)		**Block Groups**	**Census Tracts**	**Counties**
College enrollment (%)		0.242**	0.331**	0.405**
		(0.059)	*(0.025)*	*(0.042)*
Age 65 and older (%)		0.036	0.042	0.213**
		(0.056)	*(0.029)*	*(0.047)*
Local and Adjacent Economics in 2000				
Poverty (%)		0.714**	0.769**	0.738**
		(0.078)	*(0.042)*	*(0.070)*
Labor force participation (%)		0.046	-0.032	-0.094
		(0.071)	*(0.041)*	*(0.072)*
Agriculture, natural resources (%)		-0.016	0.012	0.144*
		(0.115)	*(0.073)*	*(0.079)*
Construction (%)		0.126	0.180*	0.296**
		(0.194)	*(0.107)*	*(0.143)*
Manufacturing (%)		0.098	0.130**	0.215**
		(0.111)	*(0.064)*	*(0.073)*
Transportation, communication, utilities (%)		-0.042	0.047	0.259**
		(0.152)	*(0.093)*	*(0.104)*
Wholesale trade (%)		0.018	-0.034	0.162
		(0.186)	*(0.138)*	*(0.167)*
Leisure, personal, retail services (%)		0.124	0.171**	0.179**
		(0.135)	*(0.075)*	*(0.087)*
Finance, insurance, real estate services (%)		0.027	0.169*	0.110
		(0.188)	*(0.093)*	*(0.144)*
Business, repair services (%)		0.018	-0.159	-0.313
		(0.273)	*(0.149)*	*(0.219)*
Professional, education, health services (%)		0.028	0.018	0.176*
		(0.128)	*(0.071)*	*(0.093)*
Model Fit				
Akaike Information Criteria	*Null*	128959	38513	3924
	Covariate	116913	31747	3018
	χ^2_Δ	12046**	6766**	906**
Variance Components	*Null*	167.970	122.777	33.308
	Covariate	79.505	31.652	7.004
	PRE / pR²	0.527	0.742	0.790
Spatial Dependence (in OLS Model)				
Robust Lagrange Multiplier	*Lag*	49.245**	176.681**	46.934**
	Error	88.475**	171.106**	30.077**
Moran's *I*		0.024**	0.038**	0.007

Note: n.a. indicates coefficient not available. Significant at * p<0.10, ** p<0.05.
Spatial regressions and adjacent effects use nearest neighbor weights of k=7 for block-groups, k=5 for tracts, and k=3 for counties. Block-group and tract models employ Bootstrap standard errors. Source: 2000 Census and 2006-10 ACS, U.S. Census Bureau.

Table 4. Spatial regressions of change in poverty rates from 2000-2010 on local demographic and adjacent economic covariates in 2000 in the North Central Region.

	Block Groups	**Census Tracts**	**Counties**
	N=16,197	***N=5,112***	***N=618***
	Beta	*Beta*	*Beta*
y = Change in Poverty Rate 2000-2010	*(Std Err)*	*(Std Err)*	*(Std Err)*
Intercept	-3.486	-3.924	1.542
	(3.108)	*(3.803)*	*(7.977)*
Spatial lag (ρ)	n.a.	n.a.	n.a.
Spatial error (λ)	0.124**	0.134**	0.047
	(0.015)	*(0.023)*	*(0.053)*
State fixed effects	Y	Y	Y
Local Demographics in 2000			
Metropolitan area	-1.132	-0.384	0.007
	(0.835)	*(0.561)*	*(0.424)*
Micropolitan area	-0.908	-0.437	0.019
	(0.800)	*(0.515)*	*(0.312)*
Population (1000s)	-0.251	-0.111	0.002
	(0.375)	*(0.090)*	*(0.002)*
Population density (1000s / sq.mi.)	0.187*	0.182**	-0.908*
	(0.101)	*(0.080)*	*(0.489)*
Minorities (%)	0.064**	0.036**	-0.008
	(0.019)	*(0.014)*	*(0.021)*
Single-headed families (%)	0.064**	0.070**	0.266**
	(0.032)	*(0.028)*	*(0.058)*
No high school degree (%)	0.116**	0.116**	0.021
	(0.038)	*(0.030)*	*(0.031)*
College enrollment (%)	0.189**	0.177**	0.188**
	(0.038)	*(0.026)*	*(0.038)*
Age 65 and older (%)	0.025	0.034	0.098**
	(0.035)	*(0.030)*	*(0.045)*
Local and Adjacent Economics in 2000			
Poverty (%)	-0.476**	-0.297**	-0.386**
	(0.055)	*(0.043)*	*(0.059)*
Labor force participation (%)	0.000	-0.016	-0.113
	(0.057)	*(0.042)*	*(0.070)*
Agriculture, natural resources (%)	-0.058	-0.061	-0.042
	(0.103)	*(0.074)*	*(0.077)*
Construction (%)	0.067	0.018	-0.087
	(0.138)	*(0.109)*	*(0.139)*
Manufacturing (%)	0.094	0.081	0.055
	(0.092)	*(0.064)*	*(0.072)*

Table 4 (continued)		**Block Groups**	**Census Tracts**	**Counties**
Transportation, communication, utilities (%)		-0.041	0.002	0.177*
		(0.126)	*(0.094)*	*(0.102)*
Wholesale trade (%)		-0.099	-0.165	0.096
		(0.170)	*(0.140)*	*(0.163)*
Leisure, personal, retail services (%)		0.181*	0.202**	0.103
		(0.103)	*(0.076)*	*(0.085)*
Finance, insurance, real estate services (%)		-0.133	-0.032	-0.175
		(0.126)	*(0.094)*	*(0.141)*
Business, repair services (%)		0.178	0.064	-0.406*
		(0.181)	*(0.151)*	*(0.214)*
Professional, education, health services (%)		0.069	0.039	0.070
		(0.101)	*(0.072)*	*(0.091)*
Model Fit				
Akaike Information Criteria	*Null*	119553	32560	3203
	Covariate	118265	31865	2954
	χ^2_Δ	1288**	695**	249**
Variance Components	*Null*	93.977	37.637	10.357
	Covariate	86.368	32.368	6.382
	PRE / pR²	0.081	0.140	0.384
Spatial Dependence (in OLS Model)				
Robust Lagrange Multiplier	*Lag*	129.940**	0.432	6.089**
	Error	162.071**	3.977**	6.790**
Moran's *I*		0.026**	0.043**	0.026

Note: n.a. indicates coefficient not available. Significant at * $p<0.10$, ** $p<0.05$.
Spatial regressions and adjacent effects use nearest neighbor weights of k=7 for block-groups, k=5 for tracts, and k=3 for counties. Block-group and tract models employ Bootstrap standard errors. Source: 2000 Census and 2006-10 ACS, U.S. Census Bureau.

5. Discussion and conclusion

This analysis fills a gap in the poverty literature by examining the correlates of the Great U-Turn of rising poverty across geographic scales. The first objective of the analysis is to understand how the MAUP may affect poverty research. Using larger-scale geographies tends to undercount the poor population, making these places and people statistically invisible. The effects of demographic correlates of poverty do not appreciably change across geographies, indicating that the effects generally operate independent of scale. However, the same cannot be said for employment correlates, which vary sizably across geographies even when including adjacent effects. Employment effects are strongest at the county and tract geographies. Therefore, using different geographic aggregations primarily affects the count of poor persons, the identification of poor places, and the effects of employment covariates on poverty.

The second objective of the analysis is to identify the demographic factors in both 1980 and 2000 that affect current poverty rates and its change across geographic scales. A summary of demographic findings is presented in Table 5. Some of the strongest predictors of higher and growing poverty are larger percentages of single-headed families, high school non-completers, and college students. These deleterious effects are invariant across micro and meso geographies and also across the 1980 and 2000 time periods.

While the impacts of family structure and education on poverty are well documented in the literature, the impact of college students is less clear since this control is often excluded from existing research. Students living off-campus are officially counted in the poverty population, but they have little income

while completing their studies. However, this type of poverty is unique and temporary as students are financially supported mainly by loans, scholarships, and family (support that is not officially included as income by the Census) until they complete their academic programs. Inclusion of this control minimizes the impact of high poverty college and university communities.

Minority populations also result in worse poverty outcomes across time, but the effects vary across geographic scale. Levels in 1980 only have an effect at the meso scale because poor minority populations during this period tended to be smaller and spatially diffused across the region, with broad swaths in the Dakotas (Native Americans) and southeastern Missouri (African-Americans). However, by 2000 racial and income segregation had grown markedly in urbanized areas, driven in part by in-migration of Hispanics and others. These newly arrived poor minorities tend to be concentrated in metropolitan and micropolitan neighborhoods, resulting in an effect at the micro scale.

The results show that population densities matter more than aggregate population and metropolitan residence, but the effect is not constant across time periods or spatial scales. Densely populated micro-scale neighborhoods in 1980 are more likely to have higher and growing rates of poverty in 2010. However, the opposite effect is observed at the county level, where it is associated with better poverty outcomes. The reverse effects at the county level may be attributable to aggregation errors in large population areas, where combining wealthy and poor neighborhoods may result in lower average poverty rates. By contrast, at the micro scale such aggregation errors may not be present and reflect the segregation of low income neighborhoods within counties. Despite these strong past effects, population densities in 2000 have no effect on poverty outcomes today. The difference may be attributable to demographic shifts in the NCR-W over this period. Densely populated areas in 1980 likely represent core urban centers that tend to less prosperous. By 2000 the number of densely populated suburban areas grew as the population moved from rural to urban centers, and these tend to be more prosperous.

Table 5. Summary of demographic effects on poverty rates and change.

	1980 Model						**2000 Model**					
	Poverty 2010			***Poverty Δ 1980-2010***			***Poverty 2010***			***Poverty Δ 2000-2010***		
	BG	*CT*	*CO*	*BG*	*CT*	*CO*	*BG*	*CT*	*CO*	*BG*	*CT*	*CO*
Local Demographics												
Metropolitan area	*ns*	*ns*	–	*ns*	–	–	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Micropolitan area	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Population	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Population density	+	+	–	+	+	–	*ns*	*ns*	*ns*	*ns*	+	*ns*
Minorities	*ns*	*ns*	+	*ns*	*ns*	+	*ns*	+	+	+	+	*ns*
Single-headed families	+	+	+	+	+	+	+	+	+	+	+	+
No high school degree	+	+	+	+	+	*ns*	+	+	+	+	+	*ns*
College enrollment	+	+	+	+	+	+	+	+	+	+	+	+
Age 65 and older	*ns*	*ns*	+	+	+	*ns*	*ns*	*ns*	+	*ns*	*ns*	+

Note: +/– indicates positive/negative coefficient significant at $p<0.05$. *ns* denotes non-significant effect.
BG = block group; *CT* = census tract; *CO* = county.

The recent phenomenon of rising poverty in developed economies, after a long period of decline, has been termed the Great U-Turn. One explanation given for this turnaround is the shift from an industrial to postindustrial economy, which is posited to either improve or worsen poverty. Examination of this economic shift constitutes the last objective of the analysis, with findings summarized in Table 6. First, the Great U-Turn literature argues that industrial sectors reduce poverty because they provide middle-wage jobs that are accessible to persons with limited skills, and a shift to a postindustrial economy is likely to increase poverty as these jobs disappear.

This analysis finds industrial employment, specifically construction and manufacturing, to have a variable effect on poverty across time periods and only at larger geographic scales. Industrial employment in 1980 results in faster declines in poverty between 1980 and 2010 at the county level and has no effect on base poverty rates or in smaller micro-scale neighborhoods. However, employment in these same industrial sectors in 2000 results in higher base poverty rates in 2010 – opposite of what is found in 1980. These contradictory findings generally do not support the Great U-Turn or poverty literature and suggest that the relationship between industrial jobs and social well-being has fundamentally changed over the past three decades due to employment declines, recessions, and shifts to lower value-added products.

The industrial sector in 1980 accounted for large shares of jobs, had stable employment rates, and offered above average wages and benefits in both poor and non-poor areas in the region (U.S. BEA, 2012). However, industrial centers tended to locate in core metropolitan areas that had higher base poverty rates. As a result, past industrial employment only slowed growth in poverty, without lowering overall base rates. By 2000 the industrial sector had undergone dramatic changes. Between 1980 and 2000 manufacturing experienced sizable declines in employment shares (20.0% drop), but poor areas saw much slower declines than non-poor ones (21.9% slower), resulting in greater dependence. The structure of manufacturing in the region also changed over this period, away from higher value-added machinery and electronics products in 1980 to lower value-added food products by 2000 (U.S. BEA, 2012). In another goods-producing sector, construction saw growth in the region between 1980 and 2000 (12.3% gain), with poor areas growing much faster than non-poor ones (62.1% faster), resulting in greater dependence. Recessions in the 2000s hit manufacturing and construction particularly hard and resulted in sizable job losses. The combined effects during the following decade likely resulted in higher base poverty rates by 2010.

Agriculture and natural resources, a traditional economic sector in the industrial economy, is associated with better poverty outcomes across all geographic scales, but not across time periods. Past employment is linked to lower and slower-growing poverty rates, as the farm economy enjoyed large employment shares and strong net farm incomes in 1980 (Park et al., 2011). The effect is present at both micro-scale rural neighborhoods and meso-scale counties, indicating it is invariant to scale differences. However, between 1980 and 2000 agriculture employment in the region experienced sharp declines (50.7% drop), as did net farm incomes (35.6% drop). By 2000 the agricultural sector had fewer workers and was less profitable than it had been in two decades previous, erasing its effect on poverty outcomes in 2010. The findings only partially support the poverty literature, indicating that agriculture results in better poverty outcomes when employment and net incomes are high. Given that employment declines are unlikely to be reversed, agriculture's effect on poverty will be minimal.

Second, there is debate in the Great U-Turn literature whether the postindustrial services sector either reduces poverty by expanding skilled middle-wage jobs (termed the professionalization thesis) or increases poverty by creating large numbers of low-skill low-wage jobs alongside a smaller number of high-skill high-wage ones (termed the polarization thesis). Shift to a postindustrial economy replaces industrial jobs with services ones, so the exact impact on poverty is unclear. In general, the analysis finds that lower-skilled services results in worse poverty outcomes and higher-skilled services in better outcomes, but effects are not constant across time or geographic scales. Thus, the results provide mixed support for both the polarization and professionalization theses and casts doubt on whether the Great U-Turn in poverty is driven by industrial restructuring.

Employment in leisure, personal, and retail services is linked to higher and faster-growing poverty, but only for 2000 employment and at higher geographic scales. This lower-skilled services sector grew 90.7 percent faster in poor places than in non-poor ones between 1980 and 2000, resulting in a larger employment base. Jobs of this type are the most accessible to poor people yet are unlikely to lift

them out of poverty. They generally pay lower wages, offer fewer benefits, are likely to be part-time or temporary, and offer little opportunity for advancement (Partridge and Rickman, 2006). This is particularly worrisome as job growth appears to be concentrated in these sectors. The finding that poor places have higher and growing employment in lower-skill services partially supports the polarization thesis and poverty literature and suggests that one consequence of the postindustrial economy is higher poverty rates associated with the growth of low-skill jobs.

By contrast, employment in professional, education, and health services is linked with lower and faster-declining poverty rates, but only for 1980 employment and at the county level. In 1980 this higher-skilled services sector accounted for about two-fifths of all employment in the NCR-W and was dominated by health services (48.4% sector employment). Three decades ago health services offered a host of well-paid jobs that were accessible to lower- and middle-skilled workers, which likely resulted in lower poverty rates in 2010. Between 1980 and 2000 the professional, education, and health service sector grew by 21.6% in the region, but poor areas saw much slower growth than non-poor areas (66.9% slower). However, health services employment declined by 9.5 percent over this period, while education-intensive professional services grew by over 300 percent. Thus, as the sector grew it also became more skill and education intensive, making jobs opportunities increasingly inaccessible to lower-skilled and lower-income workers. This likely explains why 2000 employment levels have no effect on current poverty. This finding only partially supports the poverty literature and the professionalization thesis and suggests that the postindustrial economy is creating professional jobs that are inaccessible to those with limited skills and incomes, thereby not affecting the poverty rate.

Table 6. Summary of adjacent economic effects on poverty rates and change.

	1980 Model						**2000 Model**					
	Poverty 2010			***Poverty Δ 1980-2010***			***Poverty 2010***			***Poverty Δ 2000-2010***		
	BG	*CT*	*CO*	*BG*	*CT*	*CO*	*BG*	*CT*	*CO*	*BG*	*CT*	*CO*
Local and Adjacent Economics												
Poverty	+	+	+	–	–	–	+	+	+	–	–	–
Labor force participation	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Agriculture, natural resources	–	–	*ns*	–	–	–	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Construction	*ns*	*ns*	*ns*	*ns*	–	–	*ns*	*ns*	+	*ns*	*ns*	*ns*
Manufacturing	*ns*	*ns*	*ns*	*ns*	*ns*	–	*ns*	*ns*	+	*ns*	*ns*	*ns*
Transportation, communication, utilities	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	+	*ns*	*ns*	*ns*
Wholesale trade	*ns*	*ns*	*ns*	*ns*	*ns*	–	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Leisure, personal, retail services	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	+	+	*ns*	+	*ns*
Finance, insurance, real estate services	*ns*	–	*ns*	–	–	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Business, repair services	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Professional, education, health services	*ns*	*ns*	–	*ns*	*ns*	–	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*

Note: +/– indicates positive/negative coefficient significant at $p<0.05$. *ns* denotes non-significant effect.
BG = block group; *CT* = census tract; *CO* = county.

In conclusion, there are several key findings that are important to regional scientists studying poverty. First, larger meso-level aggregations tend to undercount the number of poor persons and places. Second, demographic effects on poverty are stable across geographic scale and time, but economic effects vary considerably. Third, the well-established relationship between industrial sector employment and poverty has changed over the past three decades. Past employment is associated with better poverty outcomes, while current employment is associated with worse outcomes. Fourth, current employment in leisure, personal, and retail services is associated with worse poverty outcomes. No other lower-skilled services sectors are found to have an effect. Fifth, current employment in professional, education, and health services is found to have no effect in poverty, although past employment has a beneficial effect. Lastly, the results provide only mixed support for the polarization and professionalization theses. Recent trends suggest that employment in declining industrial and growing low-skill services sectors will likely increase poverty in the future, while employment in growing high-skill services will have no effect on poverty. Therefore, the results suggest that the poverty U-turn is only partially driven by economic restructuring in the NCR-W. Demographic change seems to matter more than economic change, and sectors that ought to reduce poverty have an effect inconsistent with theory. One reason for this may be that 2010 data is biased due to unique economic conditions in the region, such as the impact of the Great Recession and high farm commodity prices. More research across different regions using future economic data is needed to better explicate these complex relationships.

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Appendix. Descriptive statistics.

	Block-Groups *N=16,197*		**Census Tracts** *N=5,112*		**Counties** *N=618*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Poverty 2010 (%)	13.286	12.961	13.425	11.082	12.929	5.776
Change in Poverty 1980-2010 (Δ)	2.165	11.934	2.119	9.337	-1.699	5.374
Change in Poverty 2000-2010 (Δ)	2.225	9.694	2.282	6.136	0.823	3.221
Metropolitan area	0.589	0.492	0.599	0.490	0.181	0.386
Micropolitan area	0.184	0.387	0.166	0.372	0.194	0.396
Demographics 1980						
Population (1000s)	1.057	0.471	3.408	1.527	27.793	74.141
Population density (1000s / sq.mi.)	2.492	3.435	1.881	2.856	0.061	0.344
Minorities (%)	7.246	15.403	7.612	15.969	4.116	8.769
Single-headed families (%)	13.556	11.042	13.529	11.444	9.398	4.407
No high school degree (%)	30.310	13.009	29.900	12.963	35.204	8.426
College enrollment (%)	4.753	6.880	4.778	7.024	2.828	4.008
Age 65 and older (%)	12.996	6.546	12.615	6.317	16.008	4.125
Economics 1980						
Poverty (%)	11.120	7.818	11.305	7.945	14.628	6.009
Labor force participation (%)	44.539	6.988	44.485	7.059	41.386	4.346
Agriculture, natural resources (%)	9.356	13.395	9.814	12.910	21.010	12.245
Construction (%)	5.789	2.620	5.791	2.454	6.315	2.026
Manufacturing (%)	18.828	9.106	18.544	8.998	13.723	8.810
Transportation, communication, utilities (%)	7.440	3.507	7.416	3.363	6.449	2.668
Wholesale trade (%)	4.834	2.243	4.859	2.146	4.424	1.529
Leisure, personal, retail services (%)	20.119	5.291	19.966	4.933	18.626	3.880
Finance, insurance, real estate services (%)	5.258	2.992	5.269	2.947	3.687	1.480
Business, repair services (%)	3.387	1.777	3.396	1.704	2.367	0.854
Professional, education, health services (%)	20.740	7.671	20.655	7.381	19.431	5.034
Demographics 2000						
Population (1000s)	1.176	0.662	3.811	1.754	31.129	84.693
Population density (1000s / sq.mi.)	2.487	3.224	1.928	2.683	0.065	0.305
Minorities (%)	13.676	20.893	14.270	20.660	7.643	11.764
Single-headed families (%)	12.923	10.493	12.791	8.895	9.810	3.897
No high school degree (%)	16.241	10.524	15.902	9.380	17.924	5.974
College enrollment (%)	5.561	8.328	5.777	8.093	3.951	3.854
Age 65 and older (%)	14.487	8.206	14.048	6.374	17.570	4.546
Economics 2000						
Poverty (%)	11.060	10.119	11.143	9.238	12.106	5.961
Labor force participation (%)	49.466	8.818	49.305	7.678	47.411	4.651
Agriculture, natural resources (%)	4.614	7.912	4.873	7.591	11.958	9.311
Construction (%)	6.503	3.867	6.431	2.845	6.780	1.760
Manufacturing (%)	15.070	8.433	14.700	7.323	13.755	7.830
Transportation, communication, utilities (%)	8.030	4.101	8.069	2.984	7.612	2.236
Wholesale trade (%)	3.401	2.498	3.427	1.692	3.147	1.193
Leisure, personal, retail services (%)	24.024	7.225	23.826	5.426	22.137	4.104
Finance, insurance, real estate services (%)	6.265	4.320	6.412	3.600	4.549	1.746
Business, repair services (%)	2.783	2.652	2.779	1.919	1.821	0.946
Professional, education, health services (%)	25.212	8.602	25.346	7.136	23.830	4.427

Source: 1980 Census, 2000 Census and 2006-10 ACS, U.S. Census Bureau.