An Analysis of Regional Economic Growth in the U.S. Midwest

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Abstract

In this paper we examine some of the economic forces that underlie economic growth at the county level. In an effort to describe a much more comprehensive regional economic growth model, we address a variety of different growth hypotheses by introducing a large number of growth related variables. When formulating our hypotheses and specifying our growth model we make liberal use of GIS (geographical information systems) mapping software to "paint" a picture of where growth spots exist. Our empirical estimation indicates that amenities, state and local tax burdens, population, amount of primary agriculture activity, and demographics have important impacts on economic growth.

Keywords: amenities, fiscal policy, rural income growth.

AN ANALYSIS OF REGIONAL ECONOMIC GROWTH IN THE U.S. MIDWEST

Introduction

The relative importance of agriculture to the U.S. Midwest continues its century-long decline. The continuing development of ever-larger machinery, new biotech crops, and other labor saving technologies has greatly decreased the need for people in rural areas that have traditionally depended on agriculture. The last century has seen significant changes to the face of the U.S. Midwest. Many rural counties have had to come to grips with the reality that, given the current and future outlook for primary agricultural production, the future is not very attractive from a long-term growth perspective. While it is obvious that the adoption of new agricultural practices, machinery, and technologies has led to less expensive food and non-food goods for the American consumer, it is also true that the cost of this adoption has been borne by rural communities, particularly in the Midwest.

Some rural counties in the Midwest were able to offset the loss of agricultural production and marketing jobs in the last half century by bolstering local economies through manufacturing and service activities. As outsourcing production and jobs to other countries continues, such business and job opportunities are increasingly more difficult to secure. However there are other less-traditional actions that policymakers can take to foster income growth. In this paper we explore a range of factors hypothesized to explain total county income growth. In this largely data-driven endeavor, we explore various demographic, economic, agricultural, amenity, and local government and state fiscal variables that have been put forward to explain rural economic growth in both formal models and policy discussions. Our study examines economic growth in the Midwest from 1990 to 2001 in a cross-section of counties, totaling 734, in Minnesota, Wisconsin, Illinois, Iowa, Missouri, Kansas, Nebraska, and South Dakota.

Conceptual Framework

Given the complexities of describing a complete economic growth model from microeconomic foundations to the county level, we present a stylized growth model that embodies the key features hypothesized to be associated with economic growth. Total county income (TCI) at any point in time (t) is simply the product of population (P) and per capita income (PCI):

$$TCI_t = P_t * PCI_t.$$

If we consider total county income at another point in time (t+1), $TCI_{t+1} = P_{t+1} * PCI_{t+1}$, then we can write the following equation while preserving both of these time-dependent relationships:

$$\frac{TCI_{t+1}}{TCI_t} = \frac{P_{t+1}}{P_t} * \frac{PCI_{t+1}}{PCI_t}.$$

Without loss of generality, we can take logs of both sides and write total county income as a function of both growth in population and per capita income:

$$\ln\left(\frac{TCI_{t+1}}{TCI_t}\right) = \ln\left(\frac{P_{t+1}}{P_t}\right) * \ln\left(\frac{PCI_{t+1}}{PCI_t}\right).$$

Within this model we can conceptually describe how the combined effects of population and per capita income growth within a given county can be explained by a set of initial conditions (e.g., economic, demographic, social) or independent variables in the county.

In the growth model we specify, total county income growth between two points in time is a function of a number of initial economic and demographic conditions, region-specific characteristics, and industry composition. Adopting a Cobb-Douglas style functional form, county income growth for a county indexed by i is written as

$$\ln\left(\frac{TCI_{t+1}}{TCI_t}\right) = \ln P_{i,t} + \ln PCI_{i,t} + \ln\left(\frac{\mathrm{LCR}_{\mathrm{i,t+1}}}{LCR_{i,t}}\right) + \ln PPOP65_{i,t} + \ln PPOP2034_{i,t} + \ln PPOP20_{i,t}$$
$$+ \ln PCOL_{i,t} + \ln PPOPCOM_{i,t} + \ln NFPPC_{i,t}$$
$$+ \exp\left(\begin{array}{l} COE_{i,\mathrm{home+4}} + AI_{i,\mathrm{home+4}} + PTPC_{i,t} + TSWPC_{i,t} + STPC_{i,t} + STBPC_{i,t} + \\ PFINCF_{i,t} + NMC_{i,t} + UD_{i,t} + ID_{i,t} + UP_{i,t} + CRPSH_{i,t} + \sum_{k=1,\ldots,7} sd_{i,k} \end{array}\right) + \varepsilon_{\mathrm{i}}$$

where

$P_{i,t}$ is the population of county i in year t;

$PCI_{i,t}$ is the average per capita county income;

$LCR_{i,t}$ is the total livestock cash receipts from within the county, so $\ln\left(\frac{\mathrm{LCR}_{\mathrm{i,t+1}}}{LCR_{i,t}}\right)$ is the growth in livestock cash receipts over the period t to t+1;

$PPOP65_{i,t}$ is the percentage of the county population aged 65 plus;

$PPOP2034_{i,t}$ is the percentage of the county population aged between 20 and 34;

$PPOP20_{i,t}$ is the percentage of the county population under the age of 20;

$PCOL_{i,t}$ is the percentage of the county population aged 25 with a college degree;

$PPOPCOM_{i,t}$ is the percentage of the county population that commutes 30 minutes or more to work;

$NFPPC_{i,t}$ is the number of nonfarm proprietors per capita;

$AI_{i,\mathrm{home+4}}$ is the combined amenity index for the home and neighboring counties;

$COE_{i,\mathrm{home+4}}$ is the number of U.S. Corps of Engineers (COE) swimming areas in the home and neighboring counties;

$PTPC_{i,t}$ are property taxes per capita;

$TSWPC_{i,t}$ are total government salaries and wages per capita;

$STPC_{i,t}$ are state transfer payments per capita;

$STBPC_{i,t}$ is the total state income (corporate and personal) tax burden per capita;

$PFINC_{i,t}$ is the share of the counties' income that came from farming;

$NMC_{i,t}$ is a dummy =1 if the county was located adjacent to a metro county;

$UD_{i,t}$ is a dummy variable =1 if the county had a population of 50,000 or higher in t;

$ID_{i,t}$ is a dummy variable =1 if the county has an interstate;

$UP_{i,t}$ is a dummy variable if the county was home to a significant university and was not in a major metropolitan center;

$CRPSH_{i,t}$ is the ratio of CRP acres to total crop acres;

$Sd_{i,k}$ is a dummy variable indicating the county is present in one of the k states; and

ε_i is a normally distributed random error.

To examine the factors important to economic growth in our study area, we adopt a data-driven approach, which allows us to examine the key economic factors associated with our particular study area. Each of these variables and their relationship to (regional) county income growth is explained in greater detail in the following discussion.

Initial Population and Per Capita Income

Initial population (P) and per capita income (PCI) variables allow us to control for convergence. Are the rich residents getting richer or are the populous counties getting richer? Since the population of our midwestern cross-section of counties varies considerably by state and county, examining the effects of population may allow us to assess the relative importance of initial population, or market size, to economic growth and the extent to which economies grow based on economic well-being of residents, or whether higher or lower per capita income counties grow faster, that is, do the richer counties get richer or do the poorer counties catch up?

Share of Income from Agriculture and County Growth

Since agriculture has traditionally held the greatest influence in many midwestern counties, we wish to examine the impact of agriculture's income share within the county on economic growth. To see how counties with a strong presence of agriculture have fared, we compute the share of total county income from farming (*PFINC*), which is total farm cash receipts divided by total county income. While agricultural crop production has faced increasing competition and long-run declines in real prices, some counties have enjoyed additional growth in-value added livestock activities. To account for this increase in livestock receipts, we include growth in livestock sales receipts within the county, $\ln\left(\frac{LCR_{i,t+1}}{LCR_{i,t}}\right)$, over the period of analysis.

Demographics and Education

Many rural counties have tended to age as agricultural labor has been replaced by larger machinery. This shift in the agricultural industry has left many rural counties with aging populations and a question of who will maintain the county income base. To examine the effect of aging population on county income growth, we include the percentage of the population age 65 and over (*PPOP65*). Further, to control for "the next generation" of young and working-age rural residents, we include the shares of the population under age 20 and between 20 and 34 years of age.

Central to many growth models is the role of human capital. However, in the rural Midwest we encounter what is called the "brain drain" effect, when rural residents with higher levels of human capital move to urban areas where the returns from human capital investments are higher (Huang, Orazem, and Wohlgemuth 2002). To control for the level of human capital within the county, we use the share of the population having a college degree or higher (*PCOL*).

Location Characteristics

The role of spatial location and spatial spillovers in the economic growth process has received much attention. Spatial externalities are believed to play a role in the new geographic economy (Fujita, Krugman, and Venables 1999). Indeed Khan, Orazem, and Otto (2001) found that wage growth in neighboring counties complemented population growth in the home county. However, agglomeration diseconomies arising from past manufacturing activity in urban areas (e.g., congestion, higher land values, pollution, higher labor costs) are one reason rural manufacturing was able to experience significant employment growth in the Midwest in the 1970s and 1980s (Haynes and Machunda 1987). In any case, market access and close physical proximity to large metro markets may give a county a comparative advantage over a similar county that happens to be more remote. The growth enjoyed by commuter counties is one example of a spatial externality.

The literature on agglomeration economies and economic spillovers suggests that the location of a county and access to major markets play an important role in the growth process (especially in rural areas). To control for these location-specific characteristics we include a variable measuring proximity to a metro county (*NMC*), the percentage of the county population that commutes 30 minutes or more to work (*PPOPCOM*), and the presence of an interstate in the county (*ID*). To capture any urban effect we include a dummy variable for urban counties with a population in excess of 50,000 (*UD*). Finally, since counties that contain major secondary educational institutions may enjoy additional economic benefits and externalities, we use a dummy variable (=1) if the county was home to a significant university but was not in a major metropolitan center.

Entrepreneurial Ability

At the heart of every business venture are the entrepreneurs that commit time, effort, expertise, and capital. To control for entrepreneurial presence outside of the agricultural sector we include the number of non-farm proprietors per capita (NFPPC). We postulate that a greater concentration of NFPPC reflects greater entrepreneurial activity in the county.

Amenity Index

A number of studies have indicated that amenities and quality of life play an important role in economic growth at the county level (Gottlieb 1994; Deller et al. 2001; Dissart and Deller 2000; Halstead and Deller 1997; and Rudzitis 1999). Quality of life is a multi-dimensional concept that cannot be captured by a single number but rather is composed of several attributes of differing value to different people. At the same time, studies focusing on particular quality of life attributes in location decisions of firms have found that some attributes, such as recreational amenities, are important to location decisions, especially for high technology and information-intensive firms that rely on skilled workers. A number of studies have indicated that positive amenities may be capitalized into wages and higher housing values (Roback 1982, 1988) or land values (Cheshire and Sheppard 1995). Likewise, research indicates that workers are willing to forego some wage income and incur higher housing costs in return for a higher level of amenity services. Other environmental factors such as pollution can also have an impact on labor market growth (Pagoulatos et al. 2004).

Most recreational amenities are largely classified as public goods. As a result of the non-excludability of most trails, recreational areas, and parks in the Midwest, it is appropriate to expand our interpretation of amenity benefits to "reasonable access" beyond county boundaries that are political. Residents within a county are able to enjoy the amenities in their county of residence in addition to those found in neighboring counties. For example, a survey of people who enjoy the recreational amenities of Clear Lake, Iowa, found 33 percent of the surveyed users are within 25 miles of the lake, 20 percent of the surveyed users are between 25 and 50 miles, 41 percent of the surveyed users drive somewhere between 50 and 200 miles, and 6 percent of the surveyed users are traveling a distance of 200 miles plus. Basically, one-half of the users are traveling 50 miles or more, so the benefits of Clear Lake extend far beyond the residents of the county. It is clear that any definition of amenities services should include amenities in neighboring counties. The willingness of residents to travel across county boundaries to consume amenity services, at least in neighboring counties, is only constrained by the opportunity cost of time, transportation costs, and household budgets.

The outdoor recreation amenity index (AI) we create is a function of rails-to-trails miles (*RTT*), National Resources Inventory (NRI) recreational land acres (NRI_l), NRI recreational water acres (NRI_w),[1] and comparable data on state park amenities (*SPA*). For county i the AI is calculated in the following manner:

$$AI_{i,\text{home}+4} = \ln\left(RTT_i + \sum_{j \in N_{i,4}} RTT_j + 1\right) + \ln\left(NRI_{i,l} + \sum_{j \in N_{i,4}} NRI_{j,l} + 1\right) + \ln\left(NRI_{i,w} + \sum_{j \in N_{i,4}} NRI_{j,w} + 1\right) + \ln\left(SPA_i + \sum_{j \in N_{i,4}} SPA_j + 1\right).$$

To construct *SPA,* we included the presence of the following state park attributes within each county: (i) hiking trails, (ii) fishing sites, (iii) campsites, and (iv) boat ramps. The log-specification of the displayed AI embodies the assumption that recreational amenities complement one another. This is a reasonable assumption since we would expect that a recreational water area will have more amenity value if there is also a biking or hiking trail (i.e., a rails-to-trails trail) nearby than if there is not. It is also worth noting that the type of amenities we are considering do not include visitor centers, museums, or convention facilities. While these amenities may indeed contribute to local amenity services and county income growth, we have chosen to focus on outdoor recreational amenities, which increase the value of the residents' leisure time and attract additional residents. While other amenity indices have been proposed (e.g., Deller et al. 2001), these measures of local amenities may contain too little variation or may lack the key characteristics that we are attempting to capture in our study area (e.g., McGranahan 1999).

U.S. Army Corps of Engineers Designated Swimming Areas

A second variable we use as an indicator of local recreational amenities is the number of designated swimming areas on COE (U.S. Army Corps of Engineers) projects. In exploratory analysis we found that the number of designated COE swimming areas was highly correlated with other COE recreational variables such as hiking trails, camping areas, and boat launches to name a few. As with the AI, there is obvious reason to believe the recreational benefits associated with COE projects are likely to extend beyond the county boundaries. To capture this effect we create a total COE value for each county, which is comprised of the number of COE swimming areas in the home county plus those in the surrounding counties:

$$COE_{i,\text{home}+4} = COE_i + \sum_{j \in N_{i,4}} COE_j .$$

Local Government Fiscal Variables

Another policy tool available to the local policymaker is revenue collected through taxes and other revenue sources for the county. Local government fiscal policy has the potential to both induce and retard economic growth. In general, the types of policies designed to induce growth (i.e., better government services) are countered by the taxes required to pay for those services (i.e., property taxes). Huang, Orazem, and Wohlgemuth (2002) find local government expenditures on public welfare and highways contribute positively to rural population growth in the Midwest and South. However, the same study also suggests that the net effect of both local fiscal expenditure and county taxation have a neutral or even a small negative effect on rural working-age populations.

Every five years, the U.S. Census of Governments collects detailed data for all county, town, city, and other local governments. These data contain detailed information on where local government monies have been collected and how the funds have been spent. The Census dataset is a comprehensive list of revenue sources and expenditures for local governments, ranging from property to death and gift taxes on the revenue side and from government wages to library expenses on the expenditure side. To control for the local tax burden, we use property tax expenditures per capita (PTPC), which in the

Midwest counties in our study area is the predominant source of local government revenue. To control for inefficiency in local government provision of services, we use total salaries and wages per capita (TSWPC). This particular measure allows us to capture the scale effects related to the provision of government services relative to local population size.

The third government fiscal variable is the effect of transfers from the state government to local government bodies per capita (STPC). The level of transfers to local governments from the state reflects the level of subsidization of county government by the state government. We include this local transfer variable to examine whether or not counties that have a higher level of transfers enjoy more growth (conditional on a fixed level of state tax collections).

Conservation Reserve Program

To control for the effect of the Conservation Reserve Program (CRP) on county income growth, we include the CRP program acres in 1990 relative to total crop acres (CRPSH). We hypothesize a negative sign on this variable because land taken out of production under the CRP program might be expected to reduce economic activity, and a recent study (Sullivan et al. 2004) concluded that the CRP had negative local economic impacts.

State Effects

We hypothesize that the state within which a county resides will have an impact on economic activity at the county level. Each county will have variations in economic growth that are explained by state-level factors. To control for such factors, we consider two methods for capturing the within-state effects. First, the broader state-level effect is captured by inclusion of state dummies, which allow us to control for state-level effects such as social programs, state development programs, state infrastructure, and state income taxes. We include a state dummy variable for seven of the eight states (Iowa is the default state and captured in the intercept term) in our sample when estimating the regression coefficients. While the use of state dummies is an acceptable approach for capturing the effect of a larger number of state-level variables that differ, the use of state dummy variables does not help us identify the specific state-level factors that explain state differences.

Second, to capture a specific state-level effect, we consider the impact of state income taxes on county economic growth. In a study examining the effect of state income tax on county income growth, Holcombe and Lacombe (2004) found a negative impact on per capita income growth between 1960 and 1990. We create a state income tax per capita (*STBPC*) variable, which is equal to the sum of total personal and corporate income taxes for the state divided by the state population for each state. Given estimation limitations, we do not include the state dummy variables when estimating the state income tax effects.

Data and Regional Overview

For the purposes of our study, we define the midwestern region of the United States as including Iowa, Illinois, Minnesota, Kansas, Missouri, Nebraska, South Dakota, and Wisconsin. The variable we wish to explain in this analysis is total county income growth during the 1990-2001 period. Over that period, nominal income growth averaged almost 45 percent for the 734 Midwest counties in these states.[2,3] However, income growth was clearly not uniform across states, as shown in Figure 1. For example, the average county in Minnesota, Missouri, and Wisconsin grew by over 50 percent in terms of total income while Iowa, Illinois, and South Dakota each had an average total county income growth ranging from 43 percent to 47 percent (Table 1). At the lower end were Kansas and Nebraska, whose average county income growth was about 34 percent and 26 percent, respectively. The average population in 1990 was just over 45,000, but as can be seen in Table 1 and Figure 2, these numbers varied considerably from state to state.

In 1990, the average per capita income was $15,600, with some of the higher per capita income counties occurring in Illinois and Kansas, while in Missouri a large share of counties had lower per capita incomes. This is particularly evident in the southern portion of the state (Figure 3). Population, as expected, is high in counties near larger urban centers like Chicago, Minneapolis, St. Louis, and Kansas City while many counties in Kansas, Nebraska, and South Dakota make up the less populous counties in our study (Figure 2).

In Figure 4 we notice that the most concentrated counties with residents 65+ years old are located throughout much of Missouri.

TABLE 1. Summary statistics

Variable	All States	IA	IL	MN	KS	MO	NB	SD	WI
Total county income growth, 1990-2001 (%)	44.8	43.3	47.2	51.9	33.6	55.6	26.9	44.8	57.0
Per capita income, 1990 ($)	15.71	16.01	15.91	16.25	16.84	13.43	16.59	15.16	15.77
Population, 1990	45,410	28,048	112,065	50,288	23,596	44,496	17,330	10,680	69,761
Change in livestock receipts, 1990-2001 (%)	-11.5	-7.3	-44.2	-2.7	-14.1	-7.2	-6.4	6.2	-7.5
Amenity variable, home county plus nearest 4 counties	22.13	21.59	24.01	26.24	17.49	20.60	19.12	19.82	30.64
COE swimming areas, home plus nearest 4 counties	1.23	0.75	0.68	0.64	1.90	2.82	0.51	1.85	0.21
Property taxes per capita, 1992 ($)	0.64	0.71	0.48	0.59	0.97	0.23	0.87	0.64	0.72
Revenue from state government per capita,1992 ($)	0.70	0.76	0.60	1.25	0.62	0.51	0.55	0.43	0.99
Government salaries and wages per capita,1992 ($)	0.91	0.94	0.79	1.03	1.12	0.65	1.04	0.74	0.96
Percentage of population 65+, 1990 (%)	17.4	18.3	16.1	16.5	18.7	17.4	18.9	17.3	15.7
Percentage of population 20-34, 1990 (%)	20.0	19.6	21.7	20.4	19.6	20.6	18.2	19.0	21.6
Percentage of population 25+ with college degree, 1990 (%)	13.1	13.1	12.8	13.7	14.6	10.8	13.1	13.8	13.6
Percentage of population under 20, 1990 (%)	29.50	28.90	28.60	30.50	29.10	28.60	29.80	32.00	29.50
Percentage of county income from farming, 1990 (%)	8.8	7.6	3.0	7.7	12.3	2.6	20.0	16.8	3.0
Percentage of population commuting 30+ mins., 1990 (%)	18.5	16.3	24.8	16.8	16.0	26.3	13.7	11.6	18.7
Non-farm proprietors per capita, 1990	0.089	0.090	0.082	0.089	0.106	0.084	0.095	0.090	0.076
Neighboring a metro county (=1) (%)	17.3	18.2	28.4	17.2	12.4	15.7	12.1	7.7	25.7

Table 1. Continued

Variable	All States	IA	IL	MN	KS	MO	NB	SD	WI
County population 50,000+ (=1), 1990 (%)	14.0	10.1	26.5	14.9	8.6	13.0	3.3	3.1	34.3
Interstate within the county (=1) (%)	33.2	33.3	52.9	33.3	26.7	34.8	19.8	33.8	28.6
University present in the county (=1) (%)	1.2	2.0	1.0	0.0	1.9	0.9	1.1	1.5	1.4
Composite state tax variable - per capita ($)	0.49	0.57	0.48	0.76	0.41	0.40	0.47	0.05	0.71
Share of CRP (1990 CRP acres/1987 crop acres)	0.0633	0.0812	0.0344	0.0647	0.0849	0.0364	0.0555	0.0822	0.0387

Note: All dollar values are in thousands of nominal dollars.

In Figure 5 we see that the young working-age population, individuals 20-34 years old, tend to be more concentrated in the eastern regions in the sample. The average percentage of the population with a college degree ranges from a high of 14.6 percent in Kansas to a low of 10.8 percent in Missouri. From Figure 6 we can see that Missouri tends to rank low, especially in the southern regions of the state, compared with other states in the sample.

The proportion of the population that commutes 30 minutes or more averaged 18.5 percent in 1990 for the entire sample. In Figure 7 we see the high commute time areas are primarily in the eastern states of the region and Missouri. Indeed, the share of those commuting in Missouri was 26.3 percent and Illinois was 24.8 percent (Table 1). Other location-specific parameters indicated that about 33 percent of the counties had an interstate within the county or in very close proximity to county borders, and about 14 percent of counties had a population greater than 50,000 in 1990 (Table 1). Figure 8 indicates those counties deemed close to a metro area.

For all counties the average share of farm income relative to total county income was 8.8 percent but varied a great deal by state (Figure 9). For example, the share of county income from farming averaged only 2.6 percent for Missouri counties compared with about 20 percent in Nebraska counties. Our measure of value-added agriculture, growth in livestock cash receipts (Figure 10), had an average decrease of 11.5 percent over the period from 1990 to 2001. Growth in livestock cash receipts was more widespread in counties within the states of Nebraska, South Dakota, and Minnesota than in the other states. Counties in Illinois had significant decreases while South Dakota was the only state that showed a positive livestock receipts growth rate (6.2 percent).

The computed AI for the home plus the nearest four counties averaged 22.1 for all counties in the sample. In Figure 11 we can see that Minnesota and Wisconsin dominate in terms of recreational amenities, at least in terms of amenities as defined in this study. In addition to those recreational amenities included in the AI (i.e., trails and recreational land and water acres) we also include COE swimming areas to proxy for the presence of other recreational amenities associated with federal COE projects. In the Midwest, COE projects were largely initiated for purposes of flood control, with recreational development being a secondary goal. However COE projects are often sites where recreational development occurs. Figure 12 indicates the incidence of COE designated swimming areas in the home plus nearest four counties.

Property taxes per capita range from $31 to over $2,700 (Figure 13) with an average of $640 for all counties (Table 1). It is quite clear from Figure 13 that property taxes do vary considerably from state to state. Missouri, for example, has an average per capita property tax burden of $230, which is about one-quarter of the average per capita property tax burden in Kansas of $970. In Figure 14 we can see that most of the local governments in the northern counties of Minnesota receive relatively larger transfers from the state relative to counties in states such as Missouri and South Dakota. Government salaries and wages per capita differ considerably from county to county (Figure 15). The map in Figure 15 would tend to indicate that counties in northern Minnesota and southwestern Kansas pay more on a per capita basis for their local government employees than do most counties in Missouri and South Dakota.

A comparison of state tax burdens is given in Figure 16. Since South Dakota has no personal income taxes their overall income tax burden per capita was very small at only $49 per capita in 1992. This is in sharp contrast to the per capita tax burdens of $764 experienced in Minnesota and $715 in Wisconsin. The income tax burden variable includes both corporate and personal income taxes. However most of the variation among states comes from personal income taxes, while state corporate income taxes per capita are less variable and range from $49 in South Dakota to $94 in Minnesota. The average state personal and corporate income tax burden per capita for these states was about $490 (Table 1).

Results and Impact Analysis

We estimated the county income growth model for our cross-section of midwestern states for the years 1990-2001 using standard ordinary least squares. The regression results are presented in Table 2 for two specifications of the growth model: model I with state effects and no state income tax variable, and model II with no state-level effects and the state income tax variable. Table 3 has the mean economic impacts for an average county based on the regression coefficient estimates.

Regression model I in Table 2 contains the regression coefficient estimates and standard significance tests when we included state dummy variables but excluded state

Table 2. Regression results: Local and state government variables

	Regression Model[a]	
Variable	**I**	**II**
(ln) Per capita income, 1990	-0.022	-0.028
	(-0.47)	(-0.60)
(ln) Population, 1990	0.0457***	0.045***
	(5.50)	(5.16)
Change in livestock receipts, 1990-2001	0.0245**	0.045***
	(2.50)	(4.46)
Share of CRP (1990 CRP acres/1987 crop acres)	0.131**	0.159**
	(2.12)	(2.48)
(ln) Percentage of population 65+, 1990	-0.218***	-0.246***
	(-5.18)	(-5.61)
(ln) Percentage of population 20-34, 1990	-0.128**	-0.181***
	(-2.41)	(-3.35)
(ln) Percentage of population under 20, 1990	0.023	0.099
	(0.27)	(1.12)
(ln) Percentage of population 25+ with college degree, 1990	-0.001	0.014
	(-0.06)	(0.65)
Percentage of county income from farming, 1990	-0.758***	-0.751***
	(-9.19)	(-9.02)
(ln) Percentage of population commuting 30+ mins., 1990	0.046***	0.022*
	(3.87)	(1.87)
(ln) Nonfarm proprietors per capita, 1990	0.121***	0.117***
	(5.90)	(5.51)
Neighboring a metro county (=1)	0.027***	0.032**
	(2.09)	(2.41)
County population 50,000+ (=1), 1990	-0.085***	-0.084***
	(-4.59)	(-4.35)
Interstate within the county (=1)	0.005	0.005
	(0.53)	(0.52)
University present in the county (=1)	0.021	0.027
	(0.52)	(0.63)
Illinois dummy	-0.057***	
	(-3.35)	
Kansas dummy	-0.028*	
	(-1.68)	
Minnesota dummy	0.087***	
	(4.18)	
Missouri dummy	-0.003	
	(-0.15)	
Nebraska dummy	-0.022	
	(-1.19)	
South Dakota dummy	0.08***	
	(3.63)	

Table 2. Continued

	Regression Model[a]	
Variable	**I**	**II**
Wisconsin dummy	0.081***	
	(4.02)	
County amenity variables		
Amenity variable: home county plus nearest 4 counties	0.0024**	0.0054***
	(2.40)	(5.69)
COE swimming areas: home plus nearest 4 counties	0.0032**	0.004***
	(2.25)	(2.61)
County tax variables		
Property taxes per capita, 1992	-0.052**	-0.043**
	(-2.38)	(-2.10)
Revenue from state government per capita, 1992	-0.081***	0.027
	(-2.94)	(1.19)
Government salaries and wages per capita, 1992	-0.053***	-0.098***
	(-2.59)	(-4.82)
Composite state tax variable: per capita, 1992		-0.071*
		(-1.86)
Constant	0.009	-0.090
	(0.03)	(-0.33)
R-square	0.7094	0.6732
Adjusted R-square	0.6983	0.6636
N	734	734

[a]All values in parentheses are t-statistics reflecting for the test H_0: The given coefficient is equal to zero.
*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

TABLE 3. Impact analysis: A 10 percent change in the explanatory variables for the average midwestern county

	Mean Values for Entire Sample	Change[a]	Value of Independent Variable in New State	Predicted New Total County Income ($)	Resulting Change in Total County Income ($)	Resulting Change in Total County Income Per Capita ($)
Population, 2001	49,928					
Total county income, 1990 ($)	870,018					
Total county income, 2001 ($)	1,527,177					
Income growth	0.4483234					
Per capita income 1990 ($)	15.69126	2.830973	18.5222	866,918	-3,100	-68.70
Population, 1990[b]	45119.43	208411.1	253530.5300	941,408	71,390	1,582.24
Change in livestock receipts, 1990-2001	-0.1153263	-0.0121	-0.1032	872,169	2,151	47.68
Share of CRP (1990 CRP acres/1987 crop acres)	0.0633688	0.0702025	0.1336	878,117	8,099	179.51
Percentage of population 65+, 1990	0.1744631	0.0432158	0.2177	828,992	-41,026	-909.27
Percentage of population 20-34, 1990	0.2007643	0.0386162	0.2394	850,701	-19,317	-428.12
Percentage of population under 20, 1990	0.2947124	0.0274612	0.3222	871,797	1,779	39.42
Percent of population 25+ with college degree, 1990	0.1308274	0.0515224	0.1823	869,645	-373	-8.26
Percentage of county income from farming, 1990	0.0877193	0.1001549	0.1879	806,390	-63,628	-1,410.22
Percent of population commuting 30+ mins., 1990	0.185448	0.0937841	0.2792	886,601	16,583	367.53

TABLE 3. Continued

	Mean Values for Entire Sample	Change	Value of Independent Variable in New State	Predicted New Total County Income ($)	Resulting Change in Total County Income ($)	Resulting Change in Total County Income Per Capita ($)
Nonfarm proprietors per capita, 1990	0.0893628	0.0210969	0.1105	892,594	22,576	500.35
Neighboring a metro county	0.1730245	1	1	893,600	23,582	522.67
County population 50,000+ (=1), 1990	0.140327	1	1	799,227	-70,791	-1,568.97
Interstate within the county (=1)	0.3324251	1	1	874,464	4,446	98.55
University present in the county (=1)	0.0122616	1	1	888,776	18,758	415.75
Amenity variable: home county plus nearest 4 counties	22.1339	5.69663	27.8305	882,199	12,181	269.96
COE swimming areas: home plus nearest 4 counties	1.230245	2.987488	4.2177	878,466	8,448	187.24
Property taxes per capita, 1992	0.6412	0.3445159	0.9857	854,565	-15,453	-342.50
Revenue from state government per capita, 1992	0.7021	0.3063136	1.0084	848,774	-21,244	-470.84
Government salaries and wages per capita, 1992	0.9066	0.2928845	1.1995	856,669	-13,349	-295.85

Note: State dummies suppressed.
[a] All changes reflect a one standard deviation change with the following exceptions: all dummy variables and change in livestock receipts, which reflect a 10% (ln) change from the mean.
[b] Variables whose estimated coefficients were statistically different from zero with at least a 90% level of statistical significance have been shaded.

income tax variables. This model explains approximately 71 percent of the variability in total county income growth over the period 1990-2001. The estimated coefficient for 1990 county population was significantly different from zero at a 99 percent confidence level while 1990 county per capita income was not. Since total county income is the product of population and per capita income, these results would not tend to support the basic idea of convergence based on population. That is, other things being equal, counties with low populations grew at a slower rate than did more populous counties. At the same time, the coefficient estimate for a county with a population of 50,000+ was found to be negative and statistically different from zero with at least a 99 percent level of confidence. This result coupled with the estimates for initial population implies that the relationship between growth and population is not monotonic and is dampened when the county becomes heavily urban.

The location-specific variable for the share of the population commuting 30 minutes or more and the variable for those counties that border metro areas experienced increased economic growth as indicated by the positive and statistically significant estimated coefficients. In addition, the coefficient controlling for the presence of a major university in non-metro areas was positive but not statistically significant. The dummy variable for an interstate within the county was found not to be significantly different from zero. For the demographic variables, which included the percentage of the population in different age groups and the percentage of the population with a college degree, the percentage of the population age 65 and over and the percentage of the population age 20-34 were both negative and significantly different from zero while the percentage of the population under age 20 was not statistically significant. Remember that we are controlling for population density in these regressions and that we have included a commuting variable that is designed to capture income growth in suburban areas surrounding big cities. After controlling for these variables, the presence of 20-34 year olds had a negative impact. This suggests that those rural counties that had a proportionately higher share of persons in the 34 to 65 age group had higher growth in county income. Finally, the human capital investment measured by the percentage of population with a college degree was not statistically significant.

The estimation results indicate that counties with a higher AI experienced greater economic growth, with an estimated coefficient of 0.002, which is statistically different from zero with at least a 95 percent level of confidence. Similarly, counties with COE swimming areas in the home or surrounding counties also tended to experience greater economic growth, as indicated by the estimated coefficient of 0.003, which is statistically different from zero at the 95 percent level of statistical confidence. These results would tend to imply that recreational amenities such as bike trails, recreational areas, and COE projects with recreational amenities do explain greater county economic growth.

The level of primary agriculture present within the county as a share of total county income was negative and significantly different from zero. However, growth in the livestock cash receipts had a positive and statistically significant impact.[4] These results taken together imply that counties with heavy dependence on agricultural production are disadvantaged relative to less dependent counties but counties that grow their livestock receipts, a value-adding activity, experience county income growth. The coefficient for CRP share of crop acres within the county is positive and significantly different from zero (Figure 17). This result surprised us and seems to suggest that CRP, which takes marginal land out of production, may lead to an overall increase in county income levels. One possible explanation for this result is that for land that was already in the CRP in 1990, any negative impact on county income due to the reduced economic activity associated with not farming the land may have already happened. Starting from this low base, the additional economic value associated with the increase in wildlife habitat appears to have added to the growth in county incomes. Alternatively, the positive CRP coefficient is consistent with the positive coefficients on local and COE amenities. Even though there may have been a short-term negative impact on the county when CRP acres were enrolled pre-1990, the CRP created more outdoor amenities in the county, reduced the county's reliance on primary agriculture, and contributed to county incomes while reducing dependence on primary agriculture.

To look at state effects, we include a dummy variable for each state except Iowa. We find Illinois and Kansas performed less well than did Iowa, while Minnesota, South Dakota, and Wisconsin counties outperformed Iowa counties in terms of county income growth. Nebraska and Missouri did not have statistically significant coefficients, implying no difference relative to Iowa in state-level effects while holding all other variables in the model constant.

Local fiscal policy variables were found to have statistically significant impacts on county income growth. The variable for property taxes per capita has a negative impact on county income growth, with the coefficient being significantly different from zero at the 95 percent level. The estimated coefficient for state transfers to local governments per capita was negative and statistically significant at the 99 percent level. Our control for the relative efficiency of county governments, government salaries and wages, was found to be negative and significantly different from zero with a 99 percent level of significance.

Model II in Table 2 introduces a state income tax variable, which varies by state according to the level of personal and corporate income tax per capita. Note that all state dummy variables have been dropped in this specification of the model and this is likely responsible for the change in explanatory power of the model; the adjusted r-square decreased from about 0.70 in Model I to 0.66 in Model II. The estimated coefficient for the state income tax variable was negative and significantly different from zero at a 95 percent level of confidence, indicating that higher levels of taxation per capita at the state level have a negative impact on county income growth, holding all other variables constant. In the same model we still find the coefficients for property taxes and salaries and wages have a negative impact but that the relative sizes and levels of significance change. Property taxes have a smaller impact on growth while salaries and wages appear to have a larger impact. Once we have controlled for the state tax burden, transfers to local governments from the state are actually found to have a positive, albeit statistically insignificant, impact on county income growth. Collectively, these tax results suggest that counties with a higher tax burden per capita are less attractive to investors and realize less economic growth; however, some of these tax revenues are used to educate young people who then leave for more lucrative careers in other counties or states. Therefore, the tax results do not mean that taxes are bad, but rather that taxes are negative when the objective is to maximize local economic growth as opposed to providing human capital investment. The human capital investment may prompt out-migration to areas that offer a higher return on human capital in growth-focused states and counties. If our dependant variable had been the growth in the incomes of those born and educated in the county, then we might have obtained a very different result.

Table 3 shows the estimated coefficients in model I of Table 2 and interprets their economic significance. A description of the method used to compute these impacts is found in the appendix. All dollar value impacts are computed for a representative county at the same mean. In this table most of the independent variables are increased by one standard deviation and the resulting change in total county income and the value per capita are reported in the last two columns of Table 3. The exceptions are changes to parameters captured by dummy variables, evaluated on a present/absent basis, and changes in livestock receipts, which were subjected to a 10 percent increase from the mean value. The highlighted variables are those that were statistically different from zero at a 90 percent level of statistical significance. Based on a one-standard-deviation increase in the average county population, we find an increase in per capita income of $1,582 while holding all other variables constant. Increasing the share of total county income from farming by a standard deviation would decrease the representative total county income by about $1,410 per capita. An increase in livestock receipt growth of 10 percent will increase total county income by about $2.2 million or $47 per capita. Increasing the share of CRP acres by one standard deviation within a county leads to an increase in county income of about $179 per capita.

Increasing the amenity variable by one standard deviation from the mean would result in an increase in per capita income of $270, or about $12.2 million for the average county. If the number of COE swimming areas were increased by one standard deviation, the resulting increase in per capita income would be approximately $187, or about $8.4 million for the county.

A standard deviation increase in the property tax burden from $641 per capita to $986 per capita results in a decrease in 2001 per capita income of $343. A standard deviation increase in local salaries and wages per capita from $907 to $1200 results in a decrease in per capita income of $296 or a decrease in total county income of $13.3 million.

An increase in the percentage of the population age 65+ by one standard deviation has a negative per capita impact of $909 per capita, and an increase in the percentage of the population age 20-34 by one standard deviation reduces county income by $428 per capita. Counties that border a metro area enjoyed additional county income growth, resulting in a total change in county income of $23.6 million, or $523 per capita.

Conclusions

Rural and regional economic growth is admittedly a complex issue and, in a perfect world, would include other variables that have not been covered in this analysis. However, given the economic theory, data availability, and the region of interest, this study provides a reasonable, data-based analysis of the factors underlying economic growth at the county level. The results should be of interest to academics, policymakers, and rural citizens alike. Practical considerations prevent us from going into greater detail on each aspect of the growth model. Rather than focus on a narrow subset of ideas, we opt to provide a broader growth model and incorporate a variety of different growth concepts. As a result, we are able to describe a much more comprehensive growth scenario.

It should have come as no surprise that counties with a heavy agricultural presence have not fared well relative to less agriculturally dependent counties. Indeed, the long-term trend for commodity agriculture is not encouraging, especially for those counties that greatly rely on crop production. The value-adding opportunities in agriculture are disappearing over time. However, our analysis does show that counties that have increased their value-added agriculture, measured in this study through growth in livestock sales receipts, are able to enjoy additional economic growth. This may encourage some rural counties in the Midwest with a comparative advantage in livestock production to examine and promote increased livestock production to stimulate rural incomes. At the same time, given the importance of recreational amenities in our model, expansion of livestock receipts will have to occur in an environmentally responsible manner in order to achieve future local economic growth.

Recreational amenities, both those created locally and those provided by the federal government, have a positive and statistically significant impact on county economic growth. We hypothesize that this occurs because local recreational amenities provide incentives to employers to site plants and businesses near such amenities to attract employees and their families who make residence location decisions based in part on proximity to these amenities. Further, we anticipate that recreational amenities will play an even more important role in the future as the demand for outdoor recreation grows with growing incomes, leisure time, and population. The set of regional or neighboring recreational amenities makes a county even more attractive. Individuals are mobile in their recreation and readily travel across county and even state lines to recreate. In addition, neighboring county recreational amenities may be less distant than own-county recreational amenities. Regional coordination of recreation development may allow economies of size and scale. Longer trails are generally preferred to shorter trails, larger lakes to smaller lakes, and larger parks to smaller parks. Increasing size and scale may allow for more economic provision of recreational services both on and off the recreational facility site, as well as a broader range of both publicly and privately provided recreational services.

The changes to the structure of the agricultural industry over the last 50 years have been responsible, at least in part, for the aging populations of many midwestern counties. We found that counties with an older population experience slower economic growth, and this may be of even more concern for many rural counties in the future as they start to see their tax bases erode and their services disappear (unless state and federal transfers maintain services, which will only place more burden on the state and federal treasury).

Our empirical analysis indicates that increased local tax burdens have a negative impact on growth. Local tax burdens can be reduced but this will affect the level of local services or force structural changes in service delivery. We further found evidence suggesting that higher local government salaries relative to a county's population have had a negative impact on county growth. Economies of size and scale can be capture through consolidation, reorganization, and regionalization of services. Such economies will reduce the cost of services but also will reduce local employment opportunities. If rural counties want to improve their economic vitality and growth and attract and retain businesses and people, they face some tough choices.

Figures

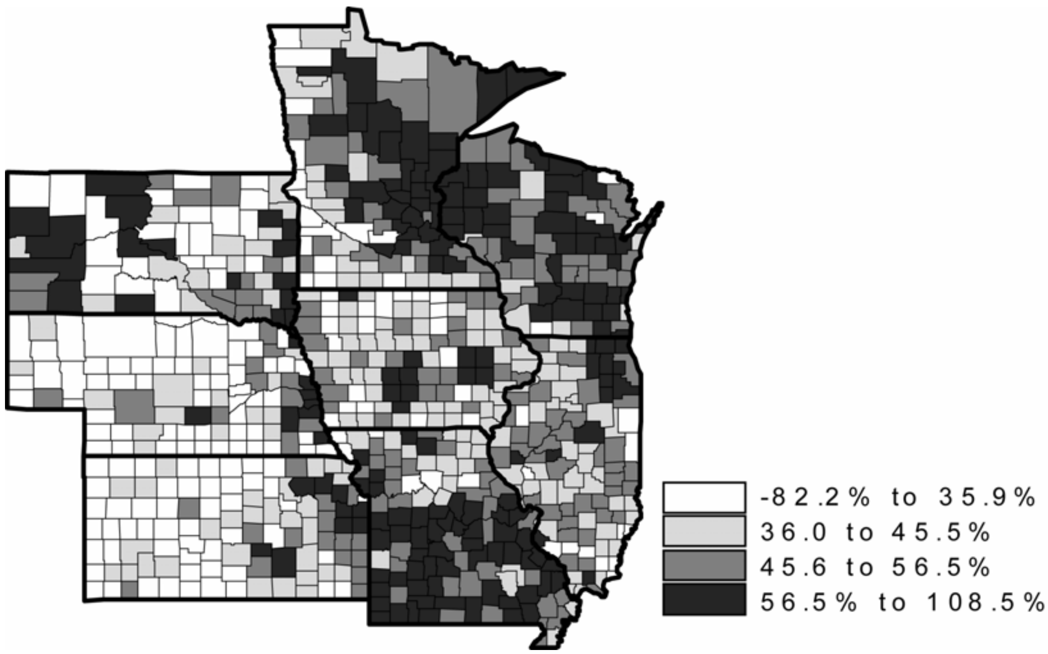

FIGURE 1. Total county income growth

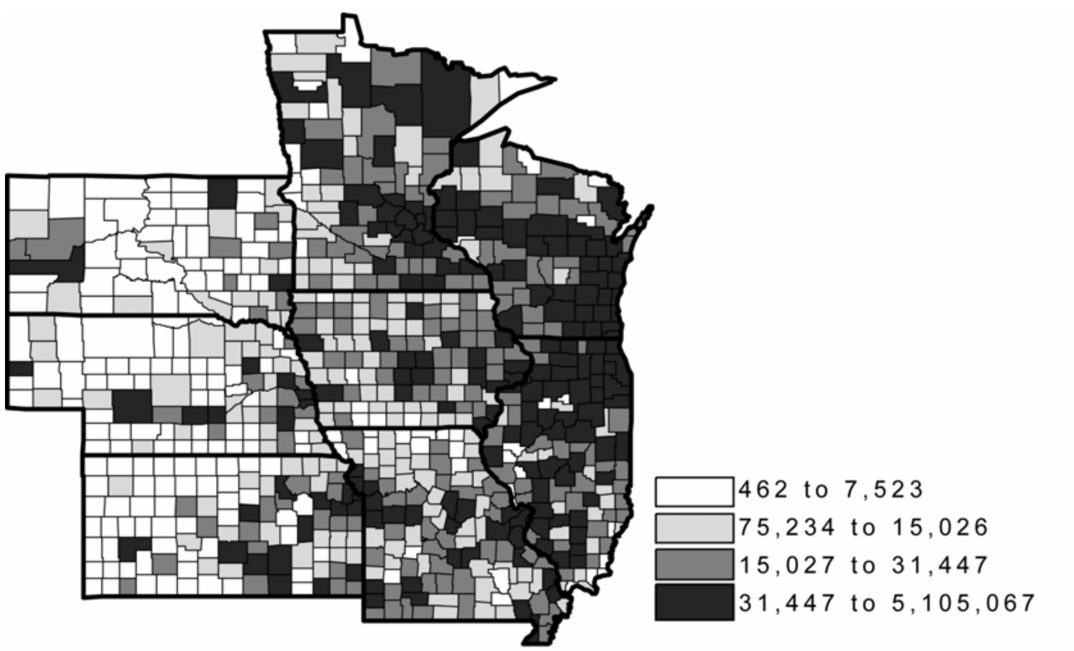

FIGURE 2. Population, 1990

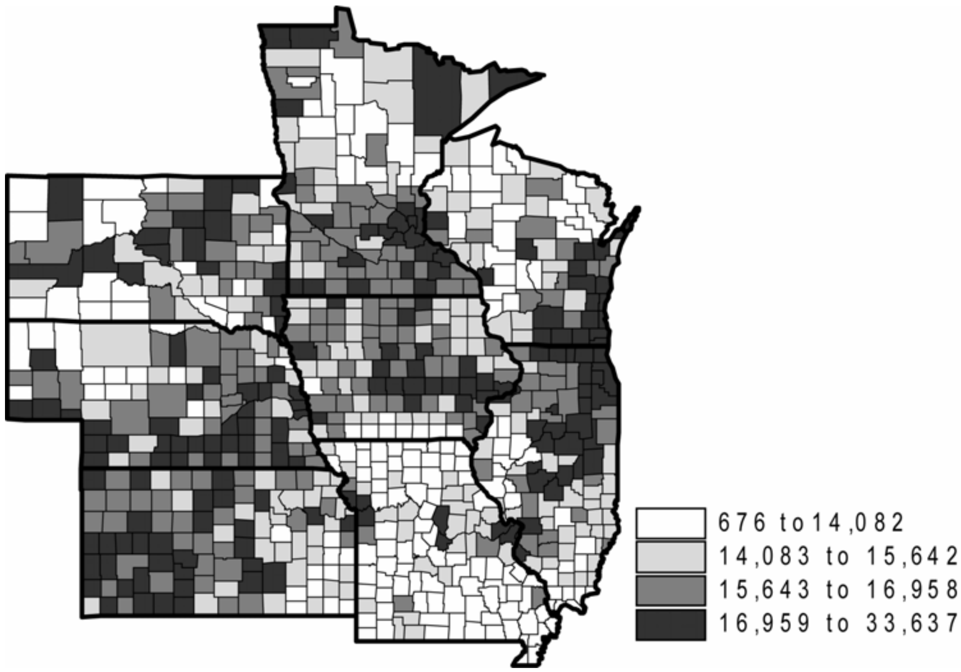

FIGURE 3. Per capita income, 1990

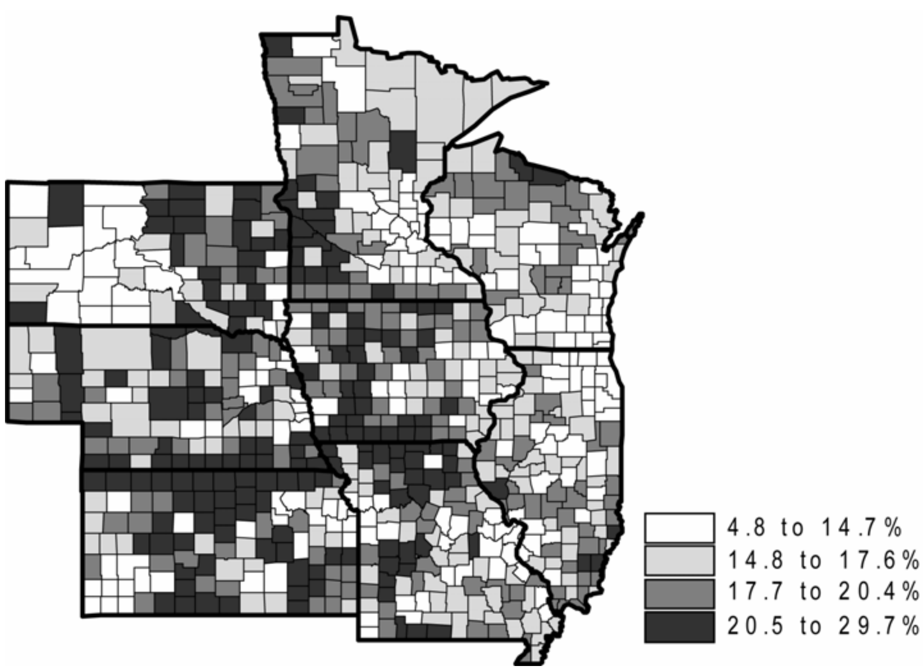

FIGURE 4. Percentage of population age 65+, 1990

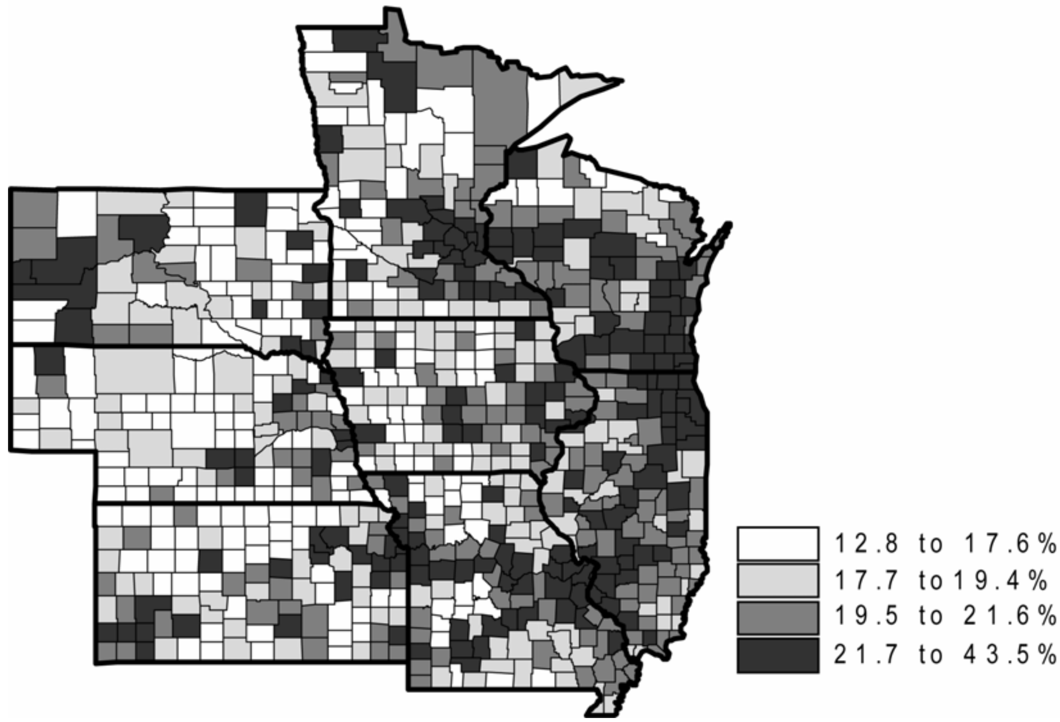

FIGURE 5. Percentage of population age 20-34, 1990

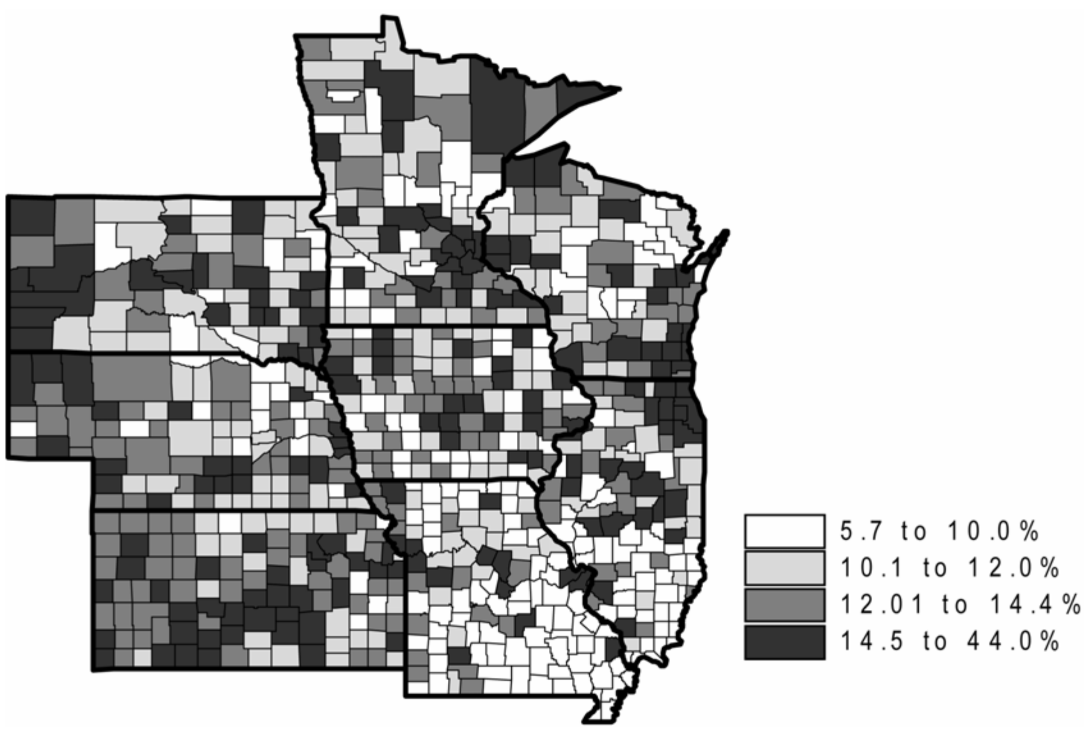

FIGURE 6. Percentage of population with a college degree, 1990

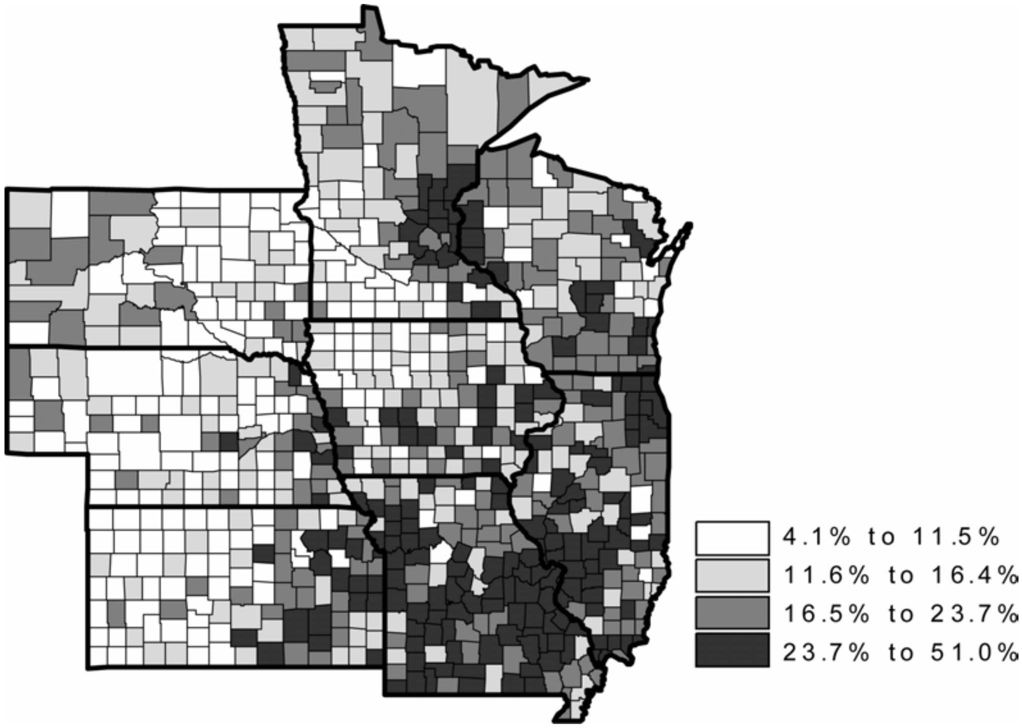

FIGURE 7. Percentage of population commuting 30+ minutes, 1990

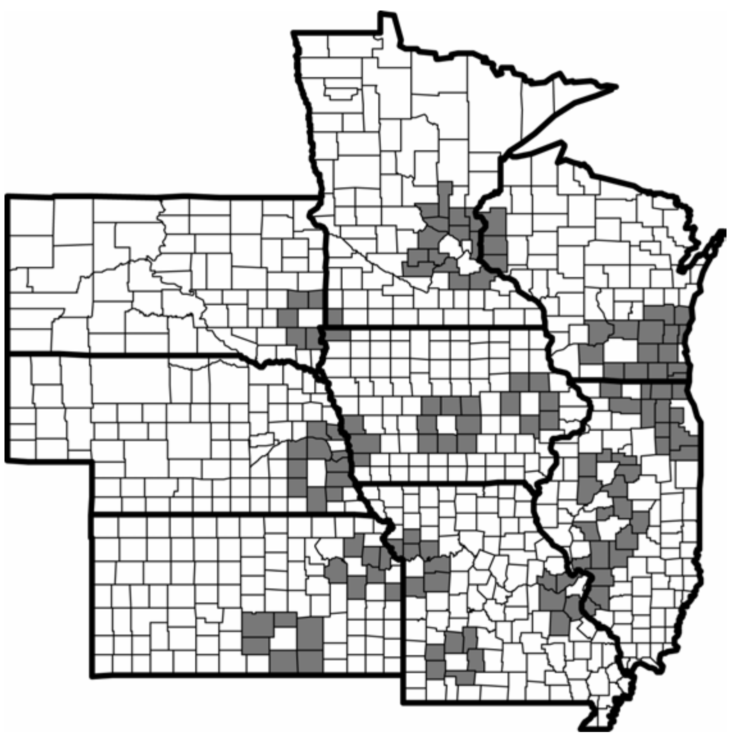

FIGURE 8. Counties near a metro county, 1990

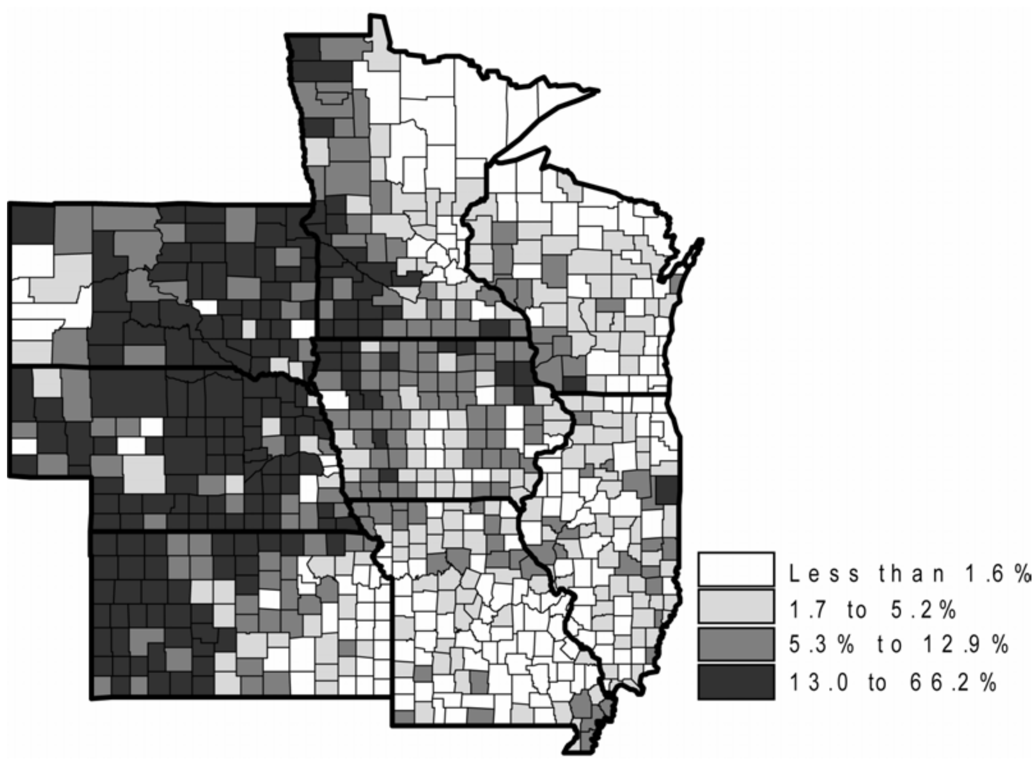

FIGURE 9. Percentage of county income from farming, 1990

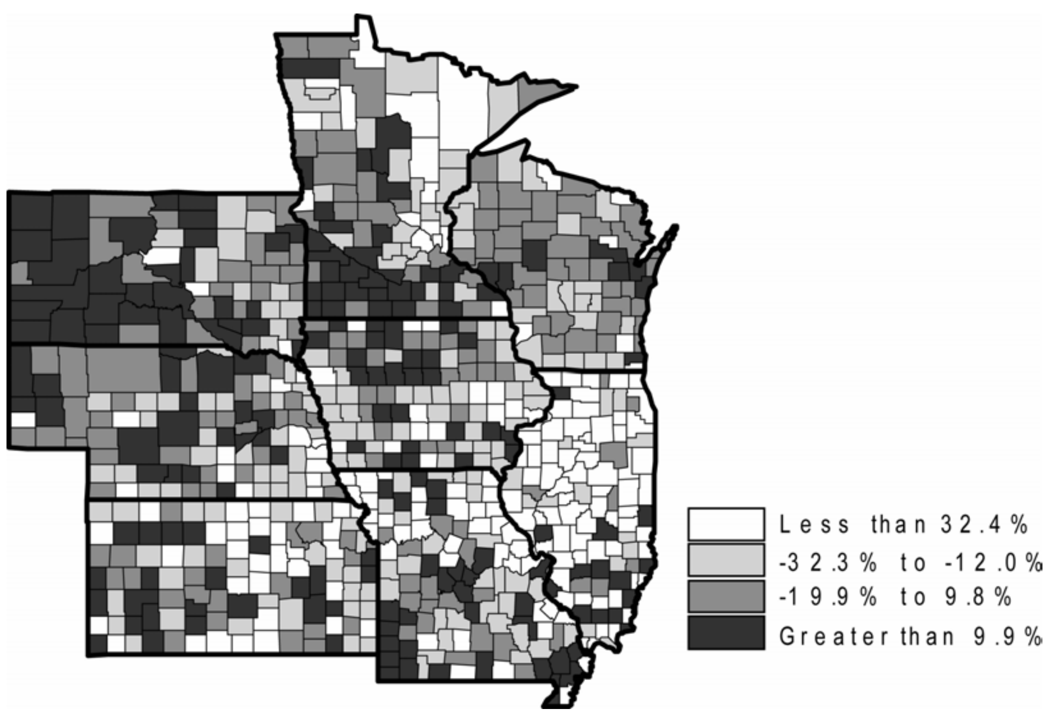

FIGURE 10. Livestock cash receipts growth, 1990-2001

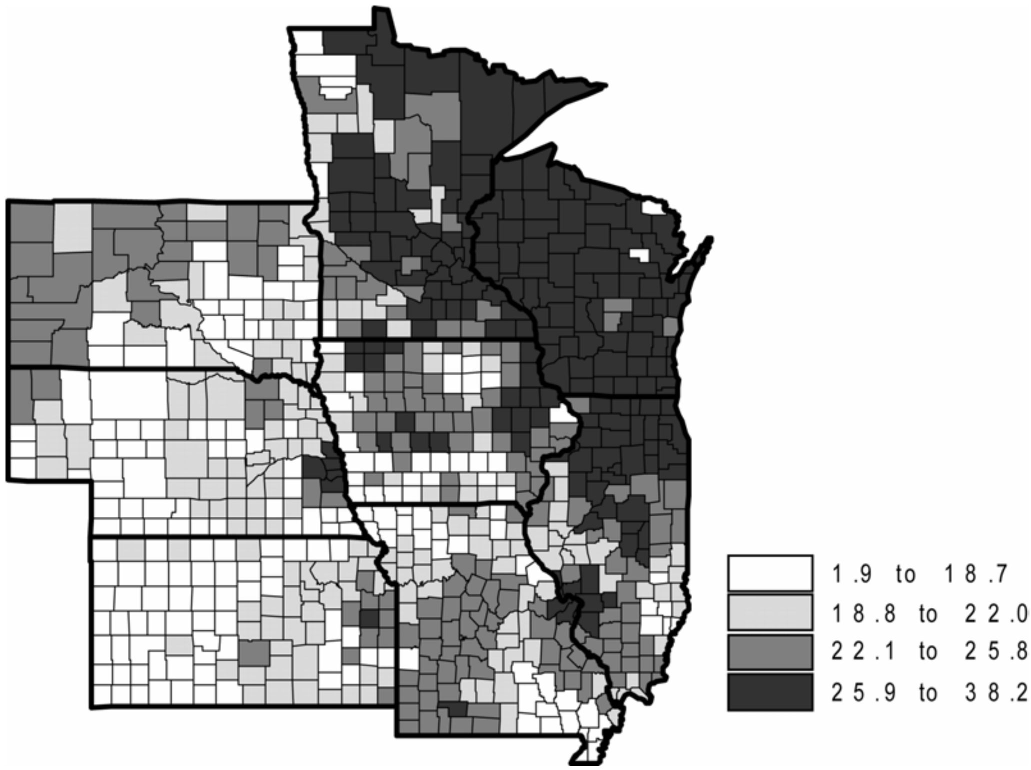

FIGURE 11. Amenities: amenity variable, home plus nearest four counties

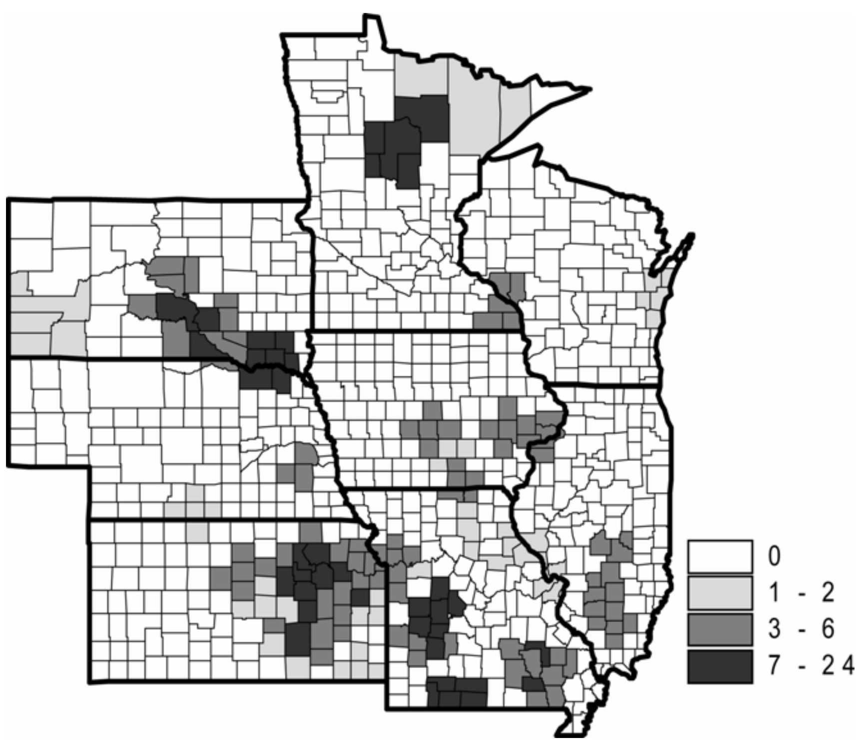

FIGURE 12. Amenities: COE swimming areas, home plus nearest four counties

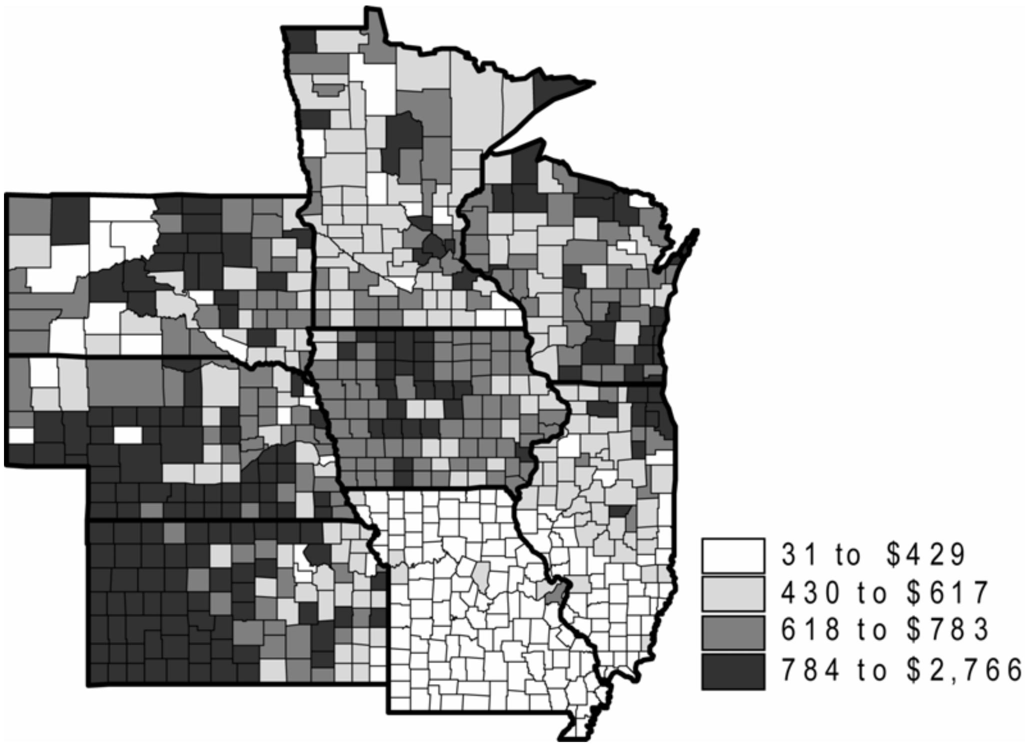

FIGURE 13. Property taxes per capita, 1992

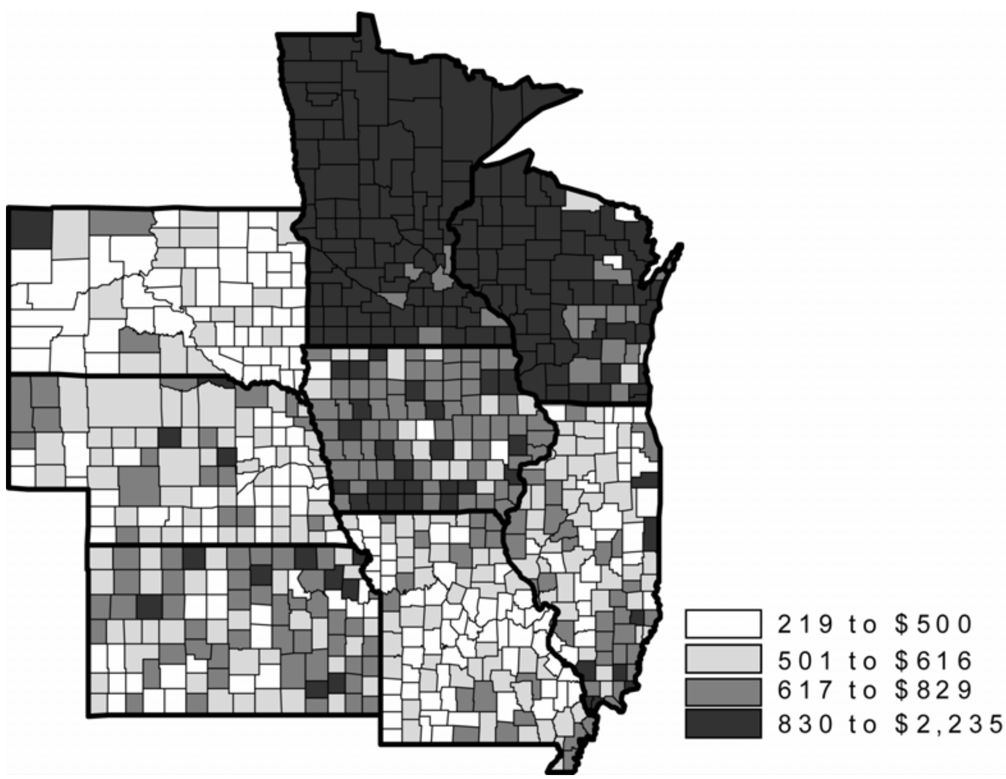

FIGURE 14. State transfers to local governments per capita, 1992

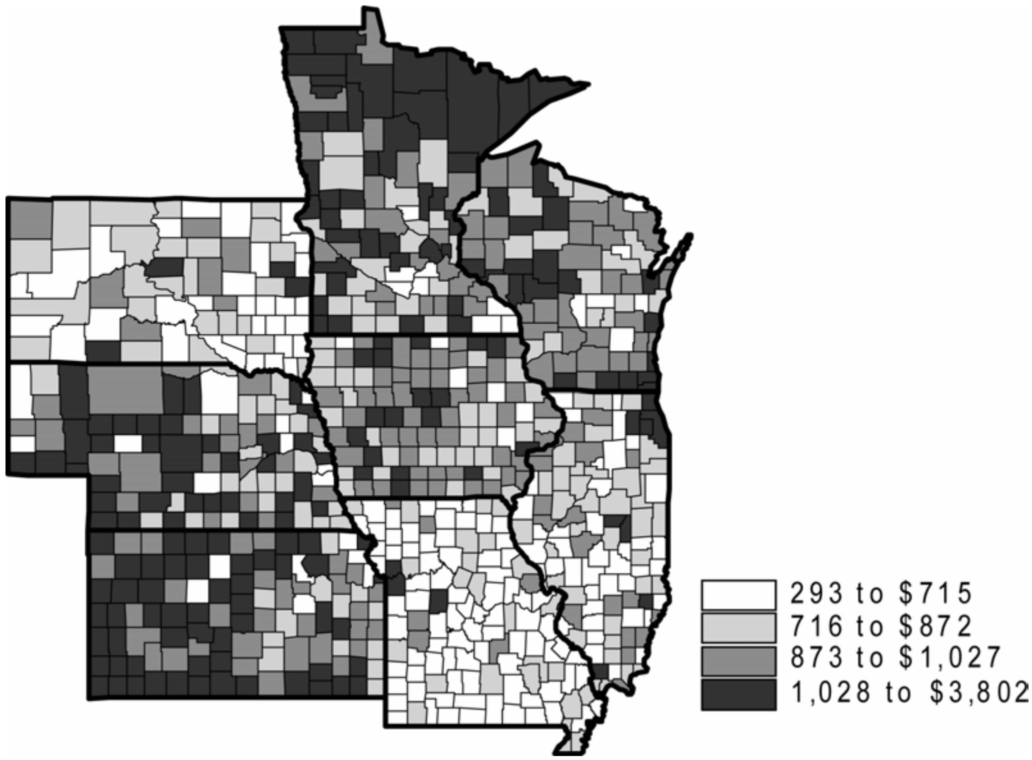

FIGURE 15. Local government salary and wage burden per capita, 1992

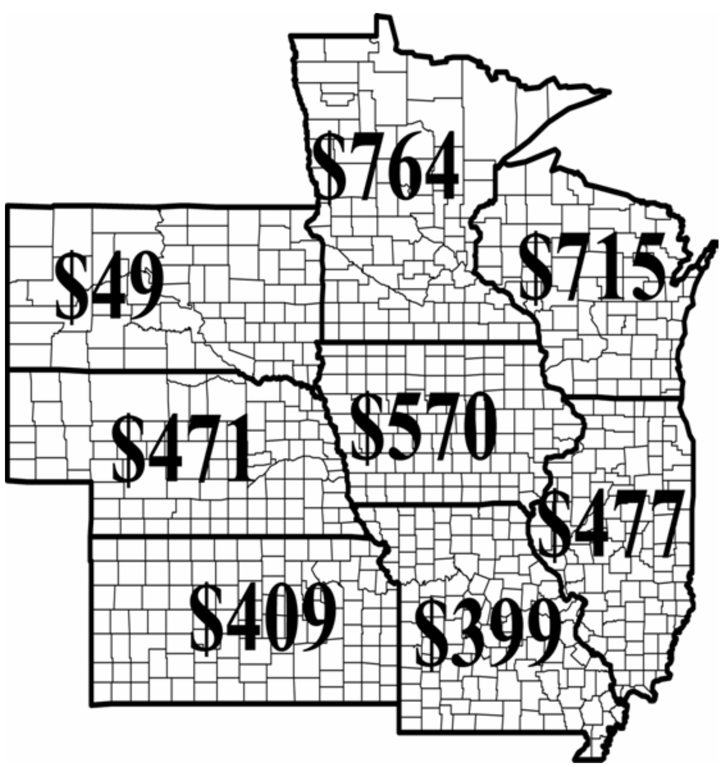

FIGURE 16. State tax burden

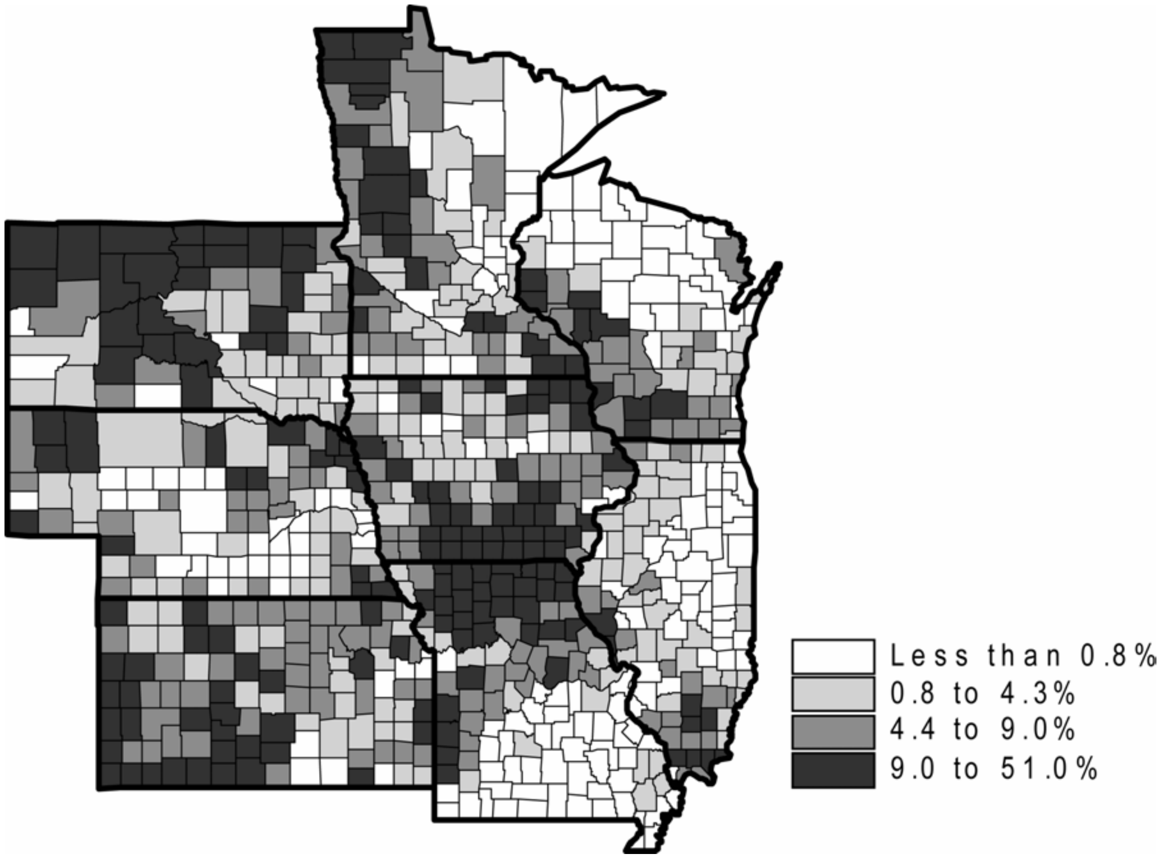

FIGURE 17. Share of crop acres in CRP, 1990 (1987 crop acres)

Endnotes

1. The *RTT* variable is the sum of all trail designations. For example, if there were 10 miles of mountain bike trail and 5 of these miles were also designated for horseback riding, the total would be 15 miles. This double counting captures the public good aspect of multiple-use trails.

2. The analysis performed is based on nominal dollars rather than real dollars. We opted not to compute real county income growth rates for two reasons. The first reason is the inability to select a suitable deflator (i.e., CPI and PPI). The second reason is that when using log growth rates, only the intercept term is affected by deflating prices for our empirical analysis.

3. Within this eight-state cross-section there are a total of 739 counties. However, due to missing data for one or more of independent variables, five counties were dropped.

4. Because this livestock variable measures the growth in livestock receipts over the period of the study, it creates a possible endogeneity problem and must be interpreted with care. The hypothesis we are testing here is whether those counties that experienced increased livestock production also experienced general economic growth. Some might argue that because livestock production is a form of economic activity it might automatically be expected to contribute to economic growth. However, many of the new livestock facilities are themselves controversial, and some have argued that the negative externalities associated with these buildings will reduce economic growth. The results suggest that the additional economic activity generated by the facilities themselves dominates the negative impact these facilities may have on the local economy.

Appendix

Method for Estimating Economic Significance of Coefficients

To interpret the results in a meaningful manner, the two logical questions that should be answered are (1) What is the change in the total county growth rate due to a change in one of the independent variables? and (2) How does this change in the growth rate translate into changes in the predicted level of future total county income? The change in growth rates for this model is written as

$$\Delta \ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right) = \ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Bigg|_{X_{i,1}} - \ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Bigg|_{X_{i,0}}$$

where $\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Big|_{X_{i,k}}$ is the county growth rate evaluated at state k=0,1 for independent variable x_i while holding all other variables constant. State k=0 may be thought of as the original situation—that is, the mean value to start with—and state k=1 may be considered the situation after a change has taken place. This change may include increasing some variable by 1 percent. This new state k=1 may also represent a discrete change such as 19.2 to 20.2 (which represents a 1 unit increase in the amenity variable and 19.2 is the Iowa average for the amenity variable).

For any given set of independent variables, the associated (or predicted) growth rate will be

$$\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right) = \alpha + \boldsymbol{\beta} X + \varepsilon \cdot$$

If there are a total of n independent variables the model can also be written as

$$\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right) = \alpha + \sum_{i=1}^{n} \beta_i x_{i,k} + \varepsilon \cdot$$

If we wish to evaluate the growth model at different states (k=0,1) of some independent variable x_i while holding all other variables constant at k=0, we need to evaluate the growth function at the two different states:

$$\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Bigg|_{x_{i,0}} = \alpha + \beta_i x_{i,0} + \sum_{j \neq i}^{n} \beta_j x_{j,0} + \varepsilon \text{,}$$

$$\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Bigg|_{x_{i,1}} = \alpha + \beta_i x_{i,1} + \sum_{j\neq i}^{n} \beta_j x_{j,0} + \varepsilon \cdot$$

After differencing the above two equations we get

$$\Delta\ln\left(\frac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right) = \alpha + \beta_i x_{i,1} + \sum_{j\neq i}^{n} \beta_j x_{j,0} + \varepsilon - \left(\alpha + \beta_i x_{i,0} + \sum_{j\neq i}^{n} \beta_j x_{j,0} + \varepsilon\right) = \beta_i\left(x_{i,1} - x_{i,0}\right)$$

This equation gives the change in the growth rate as a result of the change in the independent variable x_i from state k=0 to k=1. To compute the new total county income (i.e., in 2001) that would result from the change in x_i we use the following equation:

$$\text{Total County Income}_{2001} = \text{Total County Income}_{1990} * e^{\beta_i\left(x_{i,1}-x_{i,0}\right)}.$$

The change in total county income or additional income due to the change in the dependent variable x_i is thus

$$\begin{aligned}\Delta \text{ in Income due to } \Delta \text{ in } x_i &= \text{Total County Income}_{2001} - \text{Total County Income}_{1990} \\ &= \text{Total County Income}_{1990}\left(e^{\beta_i\left(x_{i,1}-x_{i,0}\right)} - 1\right).\end{aligned}$$

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