An Analysis of Regional Economic Growth in the US Midwest

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Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Denver, Colorado, August 1-4, 2004

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Abstract

In this paper we examine more closely some of the 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 mapping software to "paint" a picture of where growth spots exist and why. Our empirical estimation indicates amenities, state and local tax burdens, population, amount of agricultural activity, and demographics have important economic growth impacts.

Introduction

The last century has seen significant changes to the face of the US Midwest. An area once dominated by the agricultural industry is increasingly feeling the squeeze as the relative importance of primary agriculture continues to decline. 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. The development of large machinery and other labor saving technologies has left many rural county residents looking to the future with concern and uncertainty. While it is obvious that the adoption of new agricultural practices, machinery, and technologies have obviously led to a cheaper basket of food and non-food goods for the American consumer, it is also true that the cost of development has come to bear on rural America, 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. However, as outsourcing production and jobs to other countries continues, such business and job opportunities are increasingly more difficult to secure.

With the goal of growing total county incomes 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 hypothesized to explain rural economic growth in both formal models and policy discussions. Our Midwestern study examines a cross-section of counties in Minnesota, Wisconsin, Illinois, Iowa, Missouri, Kansas, Nebraska, and South Dakota for a total of 739 counties.

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 which 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 each of population and per capita income growth within a given county will likely be affected by different variables. In the discussion to follow population growth is largely argued to be a function of amenities and tax variables while per capita income growth is a argued to be a function of county characteristics related to demographic, industry characteristics, and spillovers realized through physical location of the county.

The growth literature is quite developed for general economic growth but much less so from a regional or at a least rural growth perspective. To examine the factors important to economic growth, we adopt a data-driven approach which allows us to tailor our analysis specifically to our region and county frame of study. 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

$$\ln\left(\frac{TCI_{t+1}}{TCI_t}\right) = \ln P_{i,t} + \ln PCI_{i,t} + \ln\left(\frac{LCR_{i,t+1}}{LCR_{i,t}}\right) + \ln TPPC_{i,t} + \ln PPOP65_{i,t} + \ln PPOP2034_{i,t}$$

$$+ \ln PCOL_{i,t} + \ln PPOPCOM_{i,t} + \ln NFPPC_{i,t}$$

$$+ \exp\left(\begin{array}{c} COE_{i,\text{home}+4} + AI_{i,\text{home}+4} + PTPC_{i,t} + TSWPC_{i,t} + STPC_{i,t} + STBPC_{i,t} + \\ PFINCF_{i,t} + NMC_{i,t} + UD_{i,t} + ID_{i,t} + UP_{i,t} + \sum\limits_{k=1,\ldots,7} sd_{i,k} \end{array}\right) + \varepsilon_i$$

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 $\ln\left(\frac{LCR_{i,t+1}}{LCR_{i,t}}\right)$ is the

growth in livestock cash receipts over the period t to t+1;

$TPPC_{i,t}$ is transfer payments per capita;

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

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

$PCOL_{i,t}$ is the percent of the county population aged 25 -- with a college degree or higher;

$PPOPCOM_{i,t}$ is the percent of the county population that commutes 30 minutes or more

to work;

$NFPPC_{i,t}$ is the number of non+farm proprietors per capita;

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

$COE_{i,\text{home}+4}$ is the number of COE swimming areas in the home and neighboring counties;

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

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

$STPC_{i,t}$ is 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 50k plus 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;

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

ε_i is a random error.

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) 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 assessing how population within a county matters. Additionally, do higher per capita income counties grow faster or are poorer counties growing faster and converging with richer counties.

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 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, $\ln\left(\dfrac{LCR_{i,t+1}}{LCR_{i,t}}\right)$, 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 be able to maintain the county income base. To examine the effect of aging population on county income growth we include the percent of the population 65 and over (PPOP65). Further, to control for "the next generation" of young and working age rural residents, we include the share of the population between 20 and 34.

Central to many growth models is the role of human capital. The Midwest, while tending to have a better educated population than other areas of the US (e.g. the South), witness variation in level

of education from county to county. To control for the effect of an educated population 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 Kahn, Orazem, and Otto (2001) found wage growth in geographically near counties complemented population growth in the home county. However, agglomeration diseconomies arising from past manufacturing activity in urban areas (i.e. congestion, higher land values, pollution, higher labor costs, etc.) are one reason rural manufacturing was able to experience significant employment growth in the Midwest in the 1990's as well as in the 1970's and 1980's (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 which 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 the location of a county and access to major markets play an important role in the growth process (esp. rural). To control for these location specific characteristics we include a variable indicating proximity to a metro county (NMC), the percent of the 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 included a dummy variable for urban counties with a population in excess of 50,000 (UD). Finally, since counties which contain major secondary educational institutions may enjoy additional economic benefits and externalities, we created 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). Although non-farm proprietors measures businesses, we postulate that a greater concentration of NFPPC also reflect greater entrepreneurial ability in the county.

Amenity Index

A number of studies have indicated amenities and quality of life play an important role in economic growth at the county level (Gottlieb (1994), Dissart and Dellar (2000), Halstead and Dellar (1997), and Rudzitis (1999)). Quality of life is a multi-dimensional concept that cannot be captured by a single numeric, 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, like recreation 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 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.

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 largely artificial. 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 IA found 33% of the surveyed users are within 25 miles, 20% of the surveyed users are between 25 and 50 miles, 41% of the surveyed users drive somewhere between 50 and 200 miles, and 6% of the surveyed users are traveling a distance of 200 miles plus. Basically ½ 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 should also include this ability of residents to travel freely between different counties to enjoy the amenity offerings and be limited only by their cost of time and transportation.

The recreational amenity index we create is a function of rails-to-trails miles (RTT), National Resources Inventory (NRI) recreational land acres (NRI_l), and NRI recreational water acres (NRI_w)[3]. For county i the amenity index is calculated in the following manner:

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

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[3] 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.

Summation of the three recreational amenity variables above 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 bike or hiking trail (ie. a rails-to-trails trail) nearby than if it did not. It is also worth noting here that the type of amenities we are considering do not include visitors centers, museums, or convention facilities. While these amenities may indeed contribute to local county income growth, the amenities for which we are primarily concerned are those which increase the value of the residents' leisure time and draw in additional residents. While other amenity indices have been proposed (McGranahan, 1999) such measures of local amenities may contain too little variation or lack some of the key characteristics of a particular region of interest.

COE Designated Swimming Areas

A second indicator we use as an indicator of local recreational amenities is the number of designated swimming areas on U.S. Army Corps of Engineers (COE) 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 amenity index, there is obvious reason to believe the recreational benefits associated with COE projects are likely going 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 of the policy tools available to the policy maker is revenue collected through taxes and how that money is spent within the count,. local government fiscal behavior. Every five years the US 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 sources and expenditures for local governments ranging from property to death and gift taxes on the revenue side and government wages to library expenses on the expenditure side. To control for the local tax burden we use property tax expenditures per capita (PTPC).. To control for local 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) on county income growth. The level of transfers to local governments from the state may reflect the level of subsidization from the state government. We included this local transfer variable to examine whether or not counties that that a higher level of transfers enjoy more growth..

State Tax Burden

We are primarily interested in examining the micro factors contributing to local economic growth. However it is hypothesized that the state within which county reside will have an impact on economic activity at the county level. One method we to capture the broader state effect is to include a state dummy variable for 8 states in our sample when conducting regression analysis. The inclusion of state dummies allows us to look at state effects when interested in controlling for state level effects such as social programs, state infrastructure, and state income and corporate taxes While the use of state dummies is an acceptable means to capture the effect of a large number of variables when taken together that differ by state, the use of state dummy variables does not allow closer examination of some of the specific aspects related to state differences. To capture the impact of state personal and corporate tax we create a single income tax variable which varies by state. The state tax burden per capita (STBPC) variable is equal to the sum of total personal and corporate income taxes for the entire state divided by the state population for the respective state.

State Effects

Between each state there will be variation in parameters that have not already been discussed. To control for such characteristics that vary from state to state we include a set of state dummy variables (Iowa is the default state which is omitted from estimation).

Data and Regional Overview

The variable we wish to explain in this analysis is total county income growth. Over the period from 1990 to 2001 nominal incomes grew by an average of almost 45% for this cross-section of

739 Midwestern counties[4]. However, income growth was clearly not uniform across states as indicated by figure 1. For example, the average county in Minnesota, Missouri, and Wisconsin grew by over 50% in terms of total income while Iowa, Illinois, and South Dakota each had an average total county income growth ranging from 43% to 47%. At the lower end were Kansas and Nebraska whose average county income growth was about 37% and 26% respectively. The average population in 1990 was just over 45,000 but as can be seen in table 1 and figure 2 this variable too varied considerable from state to state.

For the year 1990 the average per capita income was $15,600 (table 1) with some of the higher per capita incomes coming from counties in Illinois and Kansas, while Missouri had a large share of counties in the loser per capita income percentiles. This is particularly evident in the southern portion of the state (Figure 3). The total population, as expected, is high in counties near larger centers like Chicago, Minneapolis, St. Louis, and Kansas city while much of the state of Kansas, Nebraska, and South Dakota make up the less populous states in our study (red counties in figure 2).

In figure 5 we notice that the most concentrated counties with residents 65+ are located throughout much of Missouri (counties with a a large share are red and counties with a low share are indicated by blue in figure 5). In figure 6 we see that the young working force population, population aged 20-354, is spread quite evenly throughout the sample area with low concentrations in Missouri and north eastern Wisconsin. The average percent of the population with a college degree for our cross-section of Midwestern counties is 13% with Minnesota and South Dakota averaging 13.7% and Missouri averaging 10.8%. From figure 7 we can see Missouri tends to rank low as compared to other states in the sample.

The proportion of the population which commutes 30 minutes or more averaged 18.6% in 1990 for the entire sample. In figure 8 we see the high commute time areas are primarily in the eastern states and Missouri. Indeed, the share of those commuting in Missouri was 26.3% and Illinois was 24.8% (table 1). Other location specific parameters indicated about 33% of the counties have an interstate within the county or in very close proximity to county borders and about 14% of

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[4] 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 deals with the inability to select a suitable deflator (i.e. CPI, PPI, ..). The second reason stems from the fact that, since we are using log growth rates, only the intercept term is affected when deflating prices for out empirical analysis.

counties had a population greater than 50,000 in 1990 (table 1). Figure 11 indicates the counties which we deemed were close to a metro. For cities between 100 and 200 thousand a single ring of counties around this was used while for metro counties in excess of 200 thousand a double circle of surrounding counties was used.

For all counties the average share of farm income relative to total county income was 8.9% but also varied a great deal by state (table 1 and figure 10). For example, the share of county income from farming averaged only 2.6% for Missouri counties but was over 20% for Nebraska. Our measure of value added agriculture, growth in livestock cash receipts (figure 4), had an average decrease of 11.3% over the period from 1990 to 2001. Counties in Illinois had significant decreases while South Dakota was the only state that showed a positive growth rate (6.8%).

The computed amenity index for the home plus the nearest four counties averaged 19.8 for all counties in the sample. In figure 12 the red shaded counties are ranked among the lowest 15% of all counties while those in blue ranked in the top 15% of counties in terms of amenities. From this map we can see Minnesota and Wisconsin clearly dominate in terms of recreational amenities. At the same time, counties in South Dakota which were highly ranked based on their own amenity endowments only no longer show up as blue since these counties were did not benefit from the amenities in surrounding states like Minnesota and Wisconsin.

In addition to those recreational amenities included in the amenity index (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 COE projects. In the Midwest COE projects were largely initiated for purposes of flood control with recreational development a secondary goal. However COE projects are often sites where recreational development occurs. Figure 13 accounts the incidence of COE designated swimming areas in the home plus nearest four counties.

Property taxes per capita range anywhere from $31 to over $2,700 (figure 14) with an average of $64 for all counties (table 1). It is quite clear from figure 14 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 a quarter of the average per capita property tax burden in Kansas of $970. In figure 15 we can see most of the local governments in the northern counties of Minnesota receive relatively larger transfers from the state than do counties in states such as Missouri and South Dakota. Government salaries and wages per capita differ considerably from

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county to county (figure 16). This map would tend to indicate counties in Northern Minnesota and south western Kansas tend to pay much more on a per capita basis for their local government employees than do counties in Missouri and northwestern parts of South Dakota.

The data used to create the state tax burden is described in figure 17. Since South Dakota has no personal income taxes their overall tax burden per capita was very small at only $49 per capita in 1992. This is in sharp contrast to the per capita tax burden of $764 experienced for Minnesota with Wisconsin having the second highest tax burden per capita of $715. The tax burden variable used includes both corporate and personal income taxes. However the majority of the variation between states comes from personal income taxes while state corporate income tax per capita are less variable and ranges from $49 in South Dakota to $94 in Minnesota. The average of state personal and corporate income taxes per capita 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 OLS. The regression results are presented in table 2 for two specifications of the growth model: i) with state effects and no state tax variable, and ii) with no state effects and the state tax variable. Since the most obvious application of the findings from this research are to encourage local economic growth, a discussion of the impacts and interpreting the economic significance of the results is also included in table 3.

Regression model (I) in table 2 contains the regression results when excluding the state tax variable but including state dummy variable. This model was able to explain approximately 70% of the variability in total county income growth over the period 1990 to 2001. The estimated coefficient for initial 1990 population was found to be significant while initial 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 equal, counties with large populations grew at a faster rate than did less 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% level of confidence. This result coupled with the estimates for initial population implies that counties with a larger population grow at a faster rate but this rate needs to be adjusted downward if the county has a population greater than 50K.

The location specific variable with the share of the population commuting 30 minutes or more, and those counties which neighbored a metro areas, largely capturing the suburban effect, indicated 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 a non-metro areas was positive but not statistically significant. The controls for demographic variables included percent of the population in different age groups, transfer payments per capita, and percent of the population with a college degree.

To control for the level of primary agriculture present within the county the share of total county income from farming and was estimated to have a negative relationship which was statistically different from zero. However, to account for value added the growth in livestock output we also included a variable to capture growth in the livestock cash receipts and was estimated to have a positive and significant impact. These results taken together imply that counties with heavy emphasis on agricultural production are disadvantaged but that counties that saw their base of livestock sales growing also experience county income growth. Location specific variables such as having an interstate within the county were found to be insignificant.

We found that both population 65+ and percent of population 20-34 had a negative and statistically significant impact on county economic growth. Transfer payments per capita also had a negative result which was statistically significant (note this variable looses its statistical power in subsequent regressions). The percent of the population with a college degree was not found to have a significant impact on county income growth.

To look at state effects we included a set of state dummies where Iowa is the omitted variable. We find Illinois performed worse relative to Iowa while Minnesota, South Dakota, and Wisconsin counties outperformed Iowa counties in terms of county income growth. Nebraska, Kansas, and Missouri did not have a statistically different effect relative to Iowa while holding all other variables in the model constant.

The estimation results indicate that counties with a higher amenity index experienced greater levels of economic growth with an estimated coefficient which is statistically different from zero with at least a 95% level of confidence. Similarly, counties with COE swimming areas in the home or surrounding counties also tended to experience greater economic growth with an

estimated coefficient of 0.0031 which is statistically different from zero at the 95% level of statistical confidence. These results would tend to imply recreational amenities such as bike trails, recreational areas, and COE projects with recreational amenities do indeed tend to result in greater economic growth.

Local tax variables were found to have a statistically significant impact on county income growth. Both property taxes per capita and state transfers to local governments per capita were negative with at least a 99% level of statistical significance the estimated coefficient is different from zero. The variable for government salaries and wages was also found to be negative but at the 95% level of significance.

The second model in table 2 (II) introduces a composite state tax variable which varies by state according to the level of personal and corporate tax per capita. Note that all state dummy variables have been drop for these two models and is largely responsible for the drop in the adjusted r-square to 0.66 from about 0.7 in model I. The estimated coefficient for the composite state tax variable was negative and significantly different from zero with a 95% level of confidence indicating high levels of taxation per capita at the state level have a negative impact on county income growth. In the same model we still find property taxes and salaries and wages have a negative impact but that the relative sizes and level of significance has changed. Property taxes have a smaller impact while salaries and wages appear to have a larger impact. Interestingly, once we have controlled for the state tax burden, transfers to local governments from the state is actually found to have a positive and significant impact on county income growth.

Table 3 uses the estimated coefficients in model II of table 2 and interprets their economic significance. A description of the method used to compute these impacts is found in the appendix. Note that all dollar value impacts are computed at the mean values. In this table all of the independent variables are increased by 10% and the resulting change in total county income and the value per capita are reported in the last two columns of table 3. The variables that have been highlighted were statistically different from zero with at least a 90% level of statistical significance. Based on a 10% increase in the average county population, we find an increase in per capita income of $80 while holding all other variables constant. Increasing the percent of total county income by 10% would result in a decrease in total county income of $6,010,000 which is

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about $133 per capita while an increase in livestock receipt growth by 10% will increase total county income by about $4.13 million or $91 per capita.

By increasing the amenity variable by 1 unit from the mean would result in an increase per capita income of $103 which would convert into about $4.7 million for the average county. If the number of COE swimming areas were increased by 1 unit the resulting increase in per capita income would be $68 or about $3 million for the county.

A 10% increase in the property tax burden from $641 per capita to $709 per capita will result in a decrease in 2001 per capita income of $83. An increase in the local salaries and wages per capita from $901 to $1002 will result in a decrease in per capita income of $177 or a decrease in total county income of $7.9 million. Increasing the state tax burden per capita form $486 to $537 will decrease per capita income in 2001 by $90.

An increase in the percent of the population 65+ has a per capita impact of negative $493 and the percent of population 20-34 also has a relatively large impact of negative $351 per capita. Counties that border a metro area enjoyed additional county income growth resulting in a total change in county income of $27.3 million while counties that had populations in excess of 50,000 grew slower and would have experienced $72 million less in total county income while holding all other variables constant.

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 has conducted a reasonable analysis of the factors underlying economic growth at the county level and is of interest to both the academic and policy maker alike. Practical considerations prevent us from going into great detail on each aspect of the growth model. Rather, we opt to provide a much broader growth model and incorporate a variety of different growth related concepts rather than focus on a narrow subset of ideas, and as a result we are able to describe a much more comprehensive growth scenario.

It should have come as little surprise that counties with a heavy agricultural presence have not fared well relative to other counties. Indeed, the long term trend for agriculture in general is not encouraging especially for those counties which rely to a great deal on crop production. However,

our analysis does show that counties which 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 serve as an indicator for some rural counties in the Midwest who may have a comparative advantage in livestock production to examine and promote increased livestock production to prop up rural incomes.

Recreation 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 recreation amenities provide a favorable location to employers situating plants and businesses and because workers and their families are attracted to recreation amenities in residential location decisions. Further, we anticipate that recreation 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 recreation amenities makes a county a more attractive location than do own county recreation amenities alone. Individuals are mobile in their recreation and readily travel across county and even state lines in recreating and some neighboring county recreation amenities may be less distant than own county recreation amenities. Regional coordination of recreation development may allow economies of size and scale in recreation development. Longer trails are generally preferred to shorter trails, larger lakes to smaller lakes, and larger parks to smaller parks. Increasing size and scale may both allow for more economic provision of recreation services both on-site and off-site of the recreation facility and a broader range of recreation services provided both publicly and privately.

The structural changes to the agricultural industry over the last 50 years have been responsible, at least in part, to the aging populations in many Midwestern counties. We have found counties with an aging population experience slower economic growth and this may be of concern for many rural counties in the future as they start to see their tax base dry up and need to rely more heavily on state and federal transfers to maintain services.

Our empirical analysis indicates that increased local tax burdens have a negative impact on growth. Local tax burdens can be reduced but that will impact local services if no other changes are made. We further have found evidence suggesting counties with high local government salaries relative to the county population also have had a negative impact on growth. Economies of size and scale can be capture by consolidation, reorganization, and regionalization of services.

Such economies reduce the cost of services but also will create reduced local employment opportunities. Efficiency in service delivery can be improved in a number of ways, but efficiency gains may come at the cost of displaced staff, changed delivery systems, and reduced convenience in obtaining services. Changes in local fiscal policies are one of the factors important to improving economic vitality and growth in Midwestern counties. These changes are not without costs, but they are critical to the economic future of the state. Rural counties face a number of challenges in providing local government services. The remoteness of rural counties can increase service delivery costs, spare populations can make it difficult to achieve the economies in service delivery realized by more urban counties, declining rural populations and antiquated technology can lead to inefficiencies in service delivery, and real property provides the only significant local revenue source. Further, if rural counties want to improve their economic vitality and growth and attract and retain businesses and people, they need to provide the appropriate environment, both economic and quality of life.

References

Barro, R. "Economic Growth in a Cross-Section of Countries." _Quarterly Journal of Economics_ 106 (1991):407-444.

Blomquist, G. C, M.C. Berger, and J. P. Hoehn. "New Estimates of the Quality of Life in Urban Areas." _American Economic Review_ 79 (1988):89-107.

Castle, Emery N. "A Conceptual Framework for the Study of Rural Places." _American Journal of Agricultural Economics_ 80 (1998):621-631.

Cheshire, P., and S. Sheppard. "On the Price of Land and the Value of Amenities." _Economica_ 62 (May 1995):247-267.

Deller, S.C., T. Tsai, D.W. Marcouiller, and D.B.K English. "The Role of Amenities and Quality of Life in Rural Economic Growth." _American Journal of Agricultural Economics_ 83 (May 2001):352-365.

Dissart, J.C., and S.C. Deller. "Quality of Life the Planning Literature." _Journal of Planning Literature_ 15 (August 2000):135-61.

Fujita, M., P. Krugman, and A. Venables. _The Spatial Economy: Cites, Regions, and International Trade_. MIT Press, Cambridge MA., 1999.

Gottlieb, P.D. "Amenities as and Economic Development Tool: Is There Enough Evidence?" _Economic Development Quarterly_ 8 (August 1994):270-85.

Halstead, J.M., and S.C. Deller. "Public Infrastructure in Rural Manufacturers." _Journal of Community Development Society_ 28 (1997):149-69.

Khan, R., P.F. Orazem, and D.M. Otto. "Deriving Empirical Definitions of Spatial Labor Markets: The Roles of Competing versus Complementary Growth." _Journal of Regional Science_ 41 (2001):735-756.

Lucas, R. E. 1988. "On the Mechanics of Economic Development." _Journal of Monetary Economics_ 12 (1988):3-42.

McGranahan, David. "Natural Amenities Drive Rural Population Change." ERS. Agricultural Economic Report No. 781 (1999):32 pp.

Roback, Jennifer. "Wages, Rents, and the Quality of Life." The Journal of Political Economy. 90 (1982):1257-1278.

Roback, Jennifer. "Wages, Rents, and Amenities: Differences Among Workers and Regions." _Economic. Inquiry_ 26 (January 1988):23-41.

Rudzitis, G. "Amenities Increasingly Draw People to the Rural West." _Rural Development Perspectives_ 14 (August 1999):23-28.

Voith, R. "Capitalization of Local and Regional Attributes into Wages and Rents: Differences Across Residential, Commercial and Mixed-Use Communities." *Journal of Regional Science* 31 (1991):127-145.

Voith, R. "Changing Capitalization of CDB-Oriented Transportation Systems: Evidence from Philadelphia, 1970-1988." *Journal of Urban Economics* 33 (1993):445-464.

Appendix

To interpret the results in a meaningful manner the two logical question 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 the 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 $\ln\left(\dfrac{\text{Total County Income}_{2001}}{\text{Total County Income}_{1990}}\right)\Big|_{X_{i,k}}$ 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 – i.e. the mean value to start with, and state k=1 may be after a change has taken place. This change may include increasing some variable by 1%. 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:

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

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

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

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:

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

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

After differencing the above two equations we will get:

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

The above equation will give 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 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

$$\Delta \text{ in Income due to } \Delta \text{ in } x_i = \text{Total County Income}_{2001} - \text{Total County Income}_{1990}$$

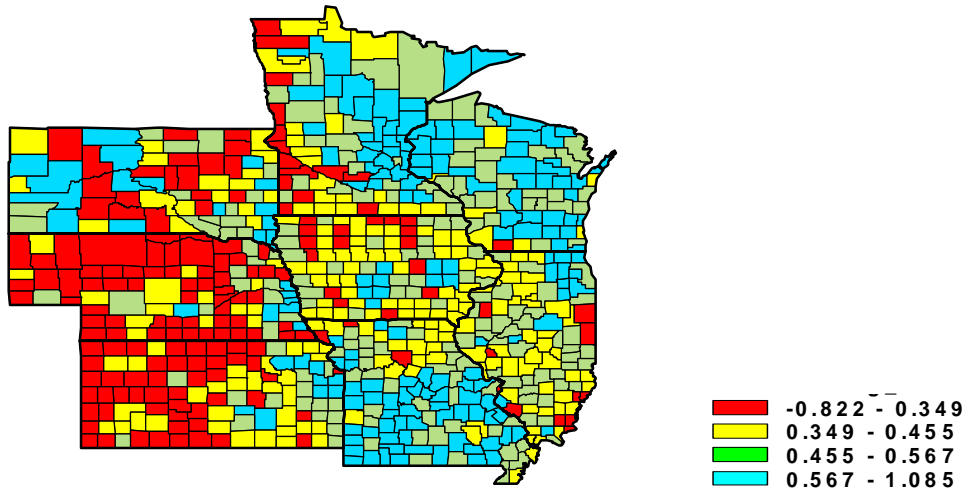$$= \text{Total County Income}_{1990}\left(e^{\beta_i\left(x_{i,1}-x_{i,0}\right)} - 1\right)$$

■ (red)	-0.822 - 0.349
■ (yellow)	0.349 - 0.455
■ (green)	0.455 - 0.567
■ (cyan)	0.567 - 1.085

Figure 1 – Total County Income Growth

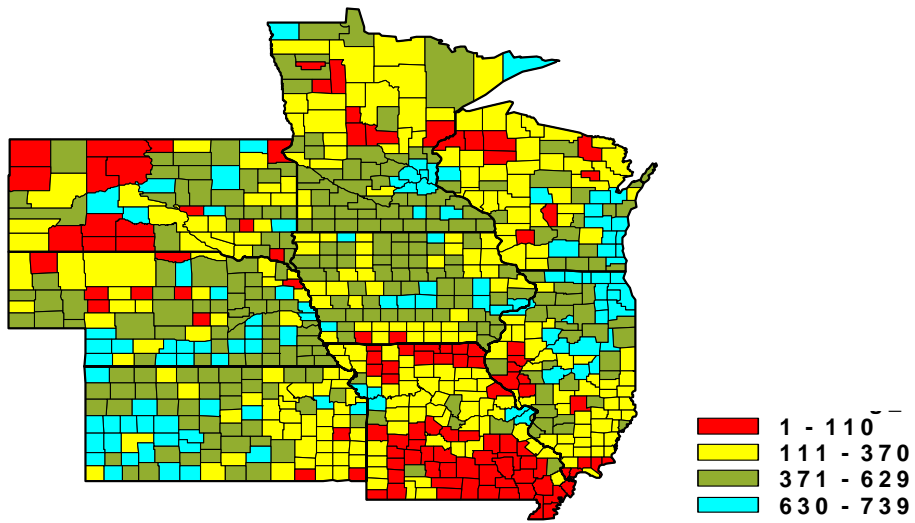|	
■ (red)	462 - 6750
■ (yellow)	6848 - 14835
■ (olive)	14909 - 32498
■ (cyan)	32508 - 5105067
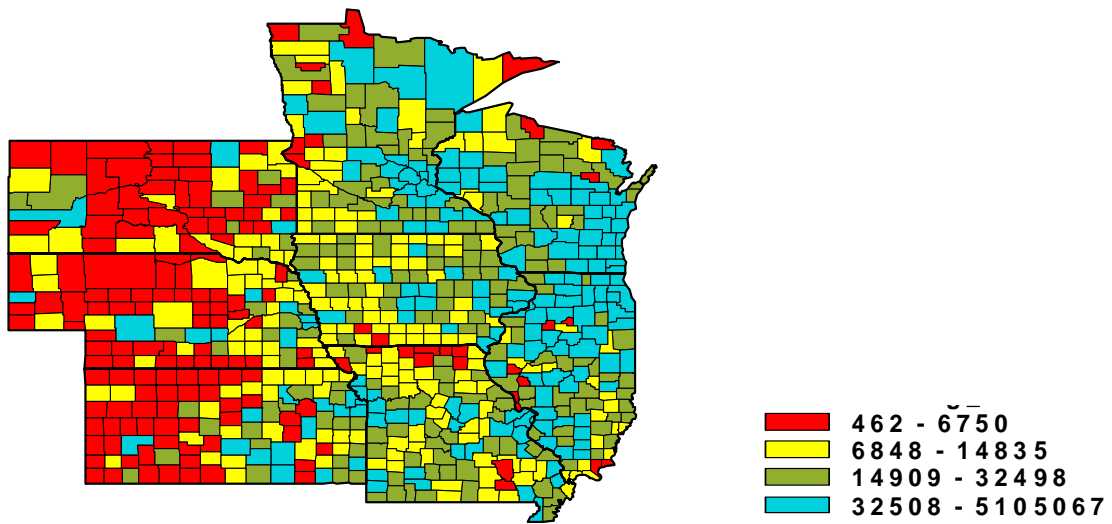
Figure 2 - Population (1990)

Figure 3 - Per Capita Income 1990
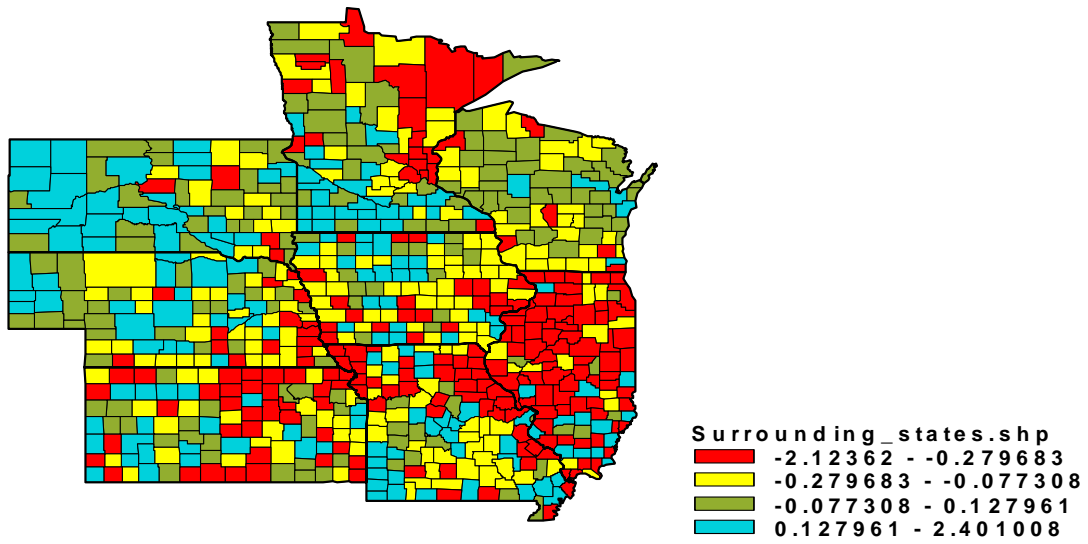
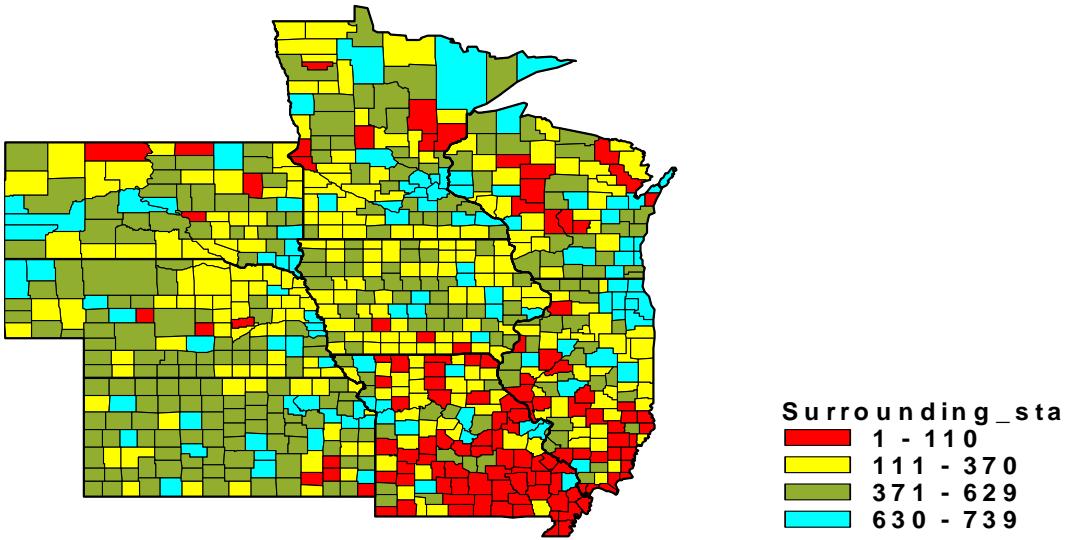Figure 4 - Livestock Cash receipts Growth 1990-2001
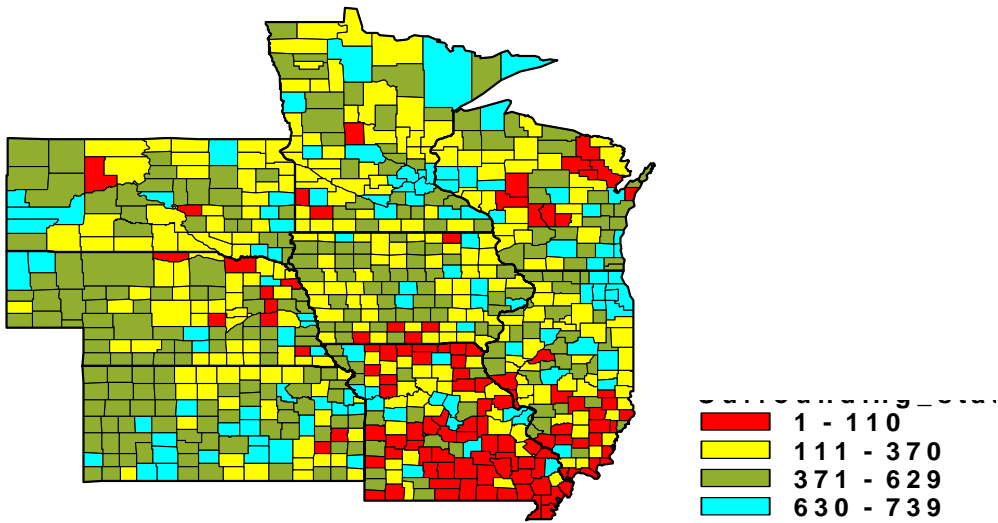
Figure 5 - Percent of Population 65+ 1990
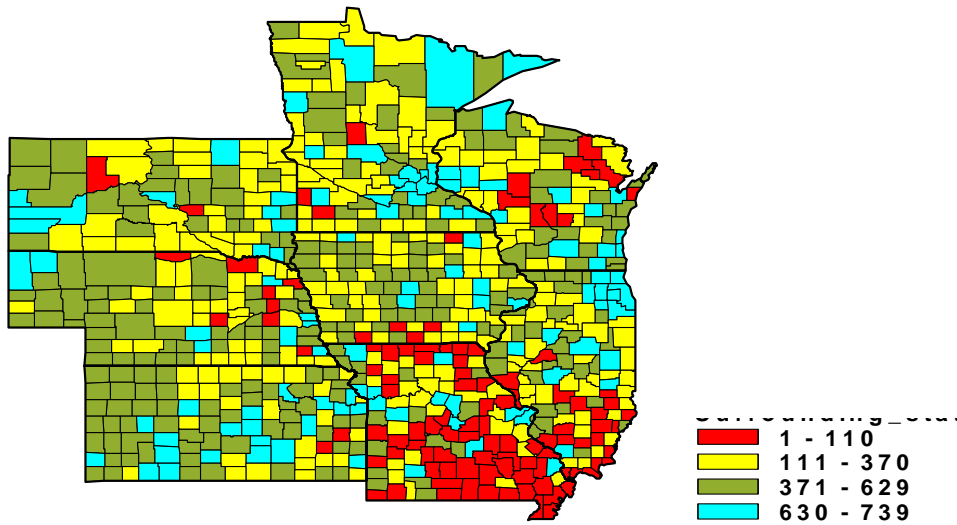

Figure 6 - Percent of Population Aged 20-34 1990

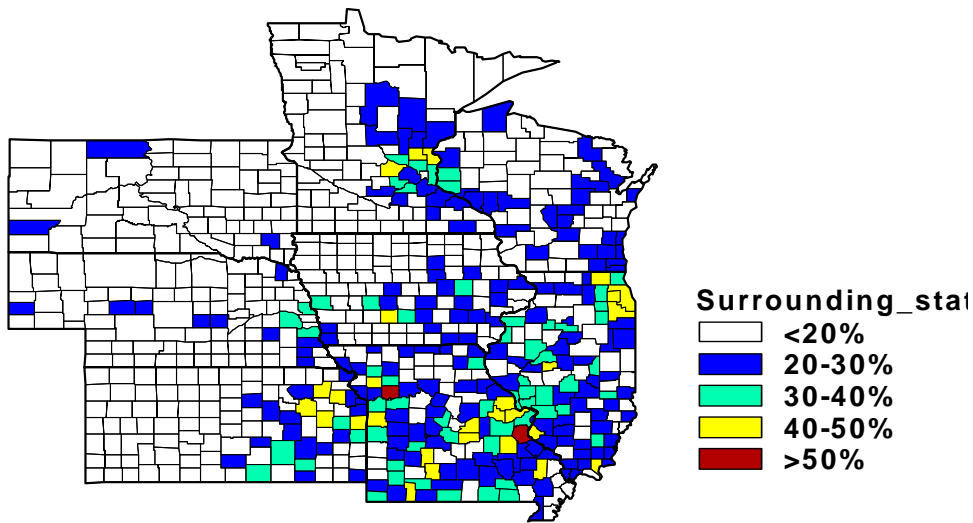Figure 7 - Percent of Population with a College Degree 1990

Figure 8 - Percent of Population Commuting 30+ minutes 1990

Surrounding_states.shp
- 0.011939 - 0.072914
- 0.072914 - 0.082628
- 0.082628 - 0.091636
- 0.091636 - 0.102419
- 0.102419 - 0.188386
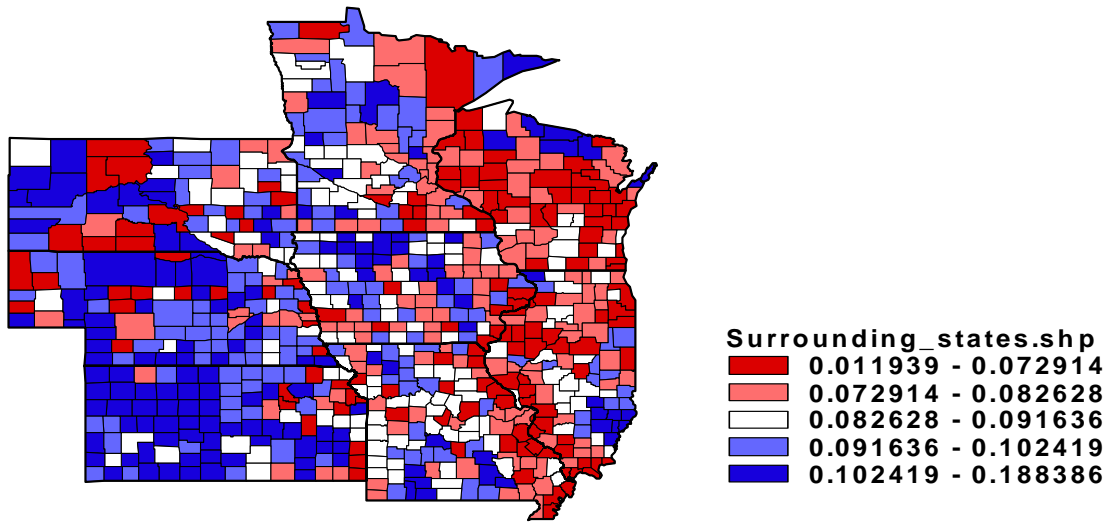
Figure 9 - Non Farm Proprietors per capita 1990

Surrounding_stat...
- 1 - 110
- 111 - 370
- 371 - 629
- 630 - 739
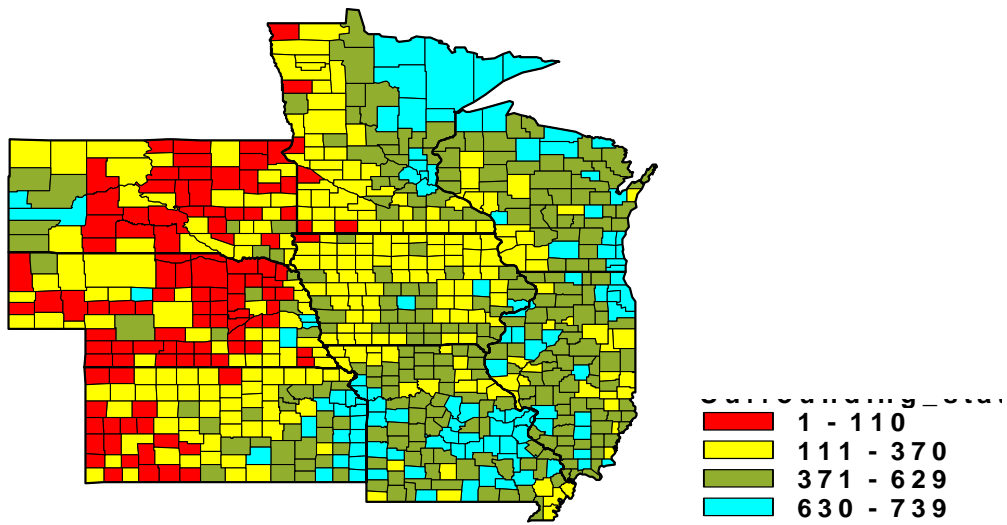
Figure 10 - Percent of County Income from Farming 1990

Surrounding cities.sh
• 100000 - 200000
• 200,000+
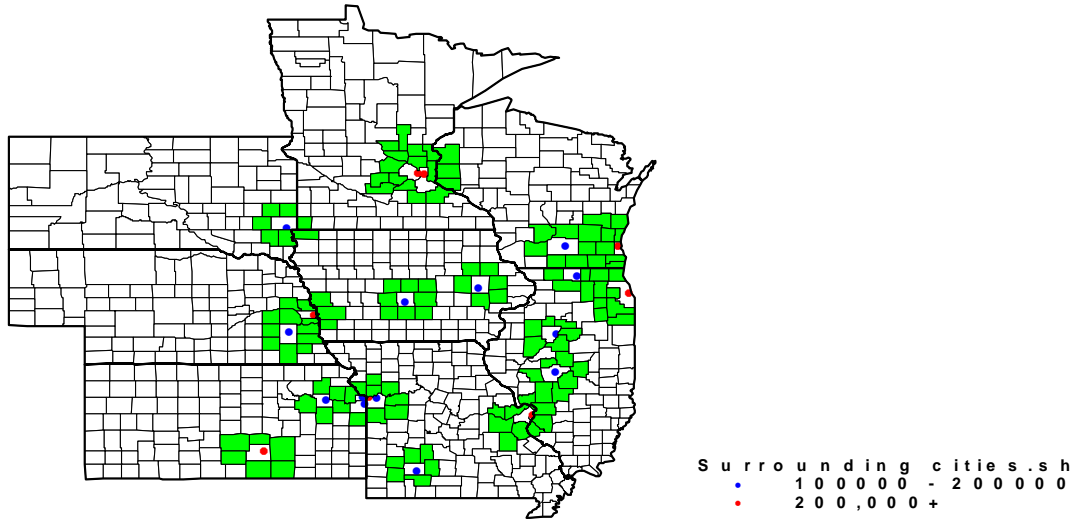
Figure 11 - Counties Near a Metro County 1990

Surrounding_states.shp
■ 1 - 110
■ 111 - 370
■ 371 - 630
■ 631 - 739
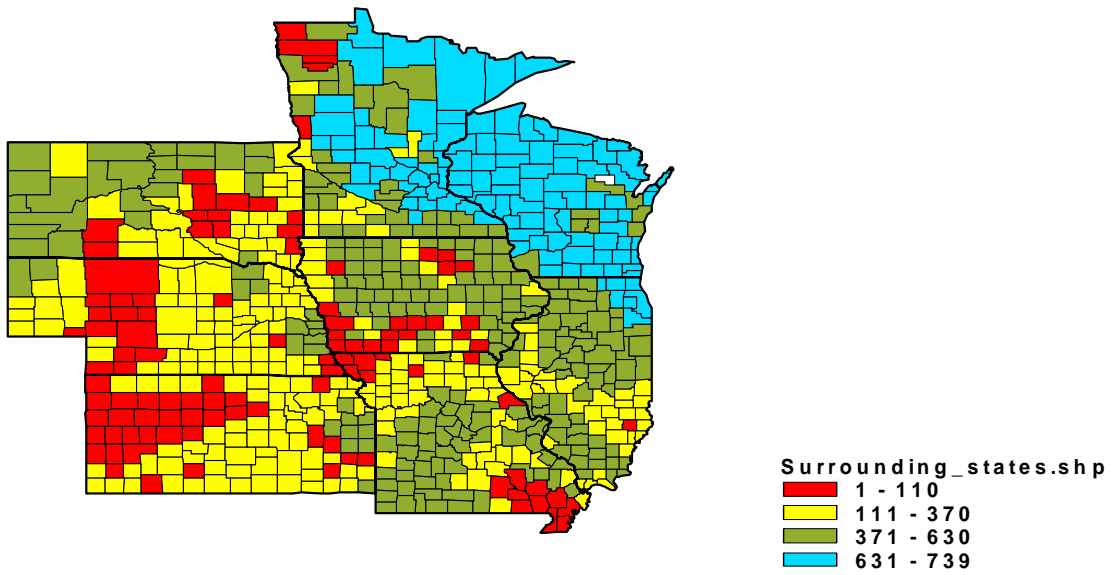
Figure 12 - Amenities – Amenity Variable – Home plus nearest 4

	0
	1 - 2
	3 - 6
	7 - 24
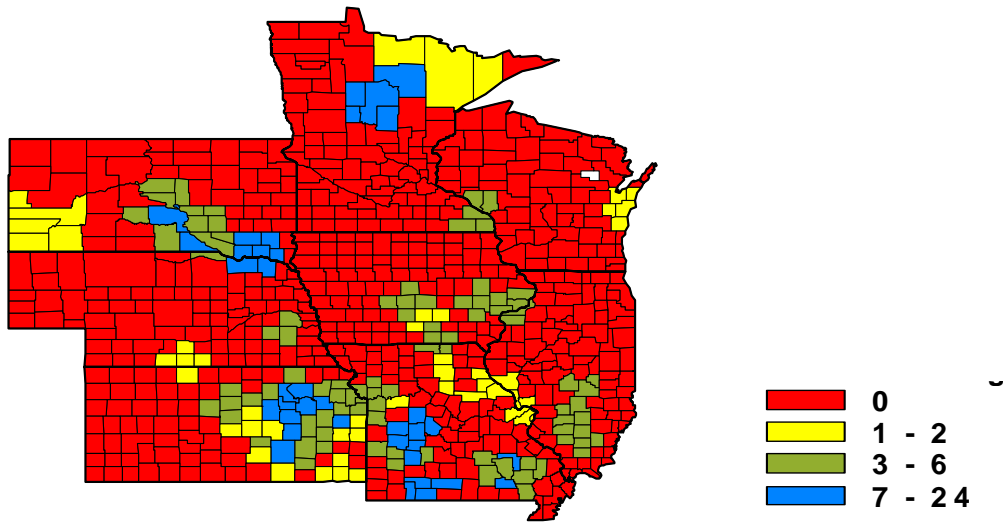
Figure 13 - Amenities – COE Swimming Areas – Home plus Nearest 4 counties

	0.031 - 0.484
	0.484 - 0.627
	0.627 - 0.795
	0.795 - 2.766

Figure 14 - Property Taxes per capita (1992)

Figure 15 - State Transfers to Local Governments per capita (1992)

Figure 16 - Local Government Salary and Wage Burden per capita (1992)

Figure 17 - State Tax Burden

Table 1 - Summary Statistics

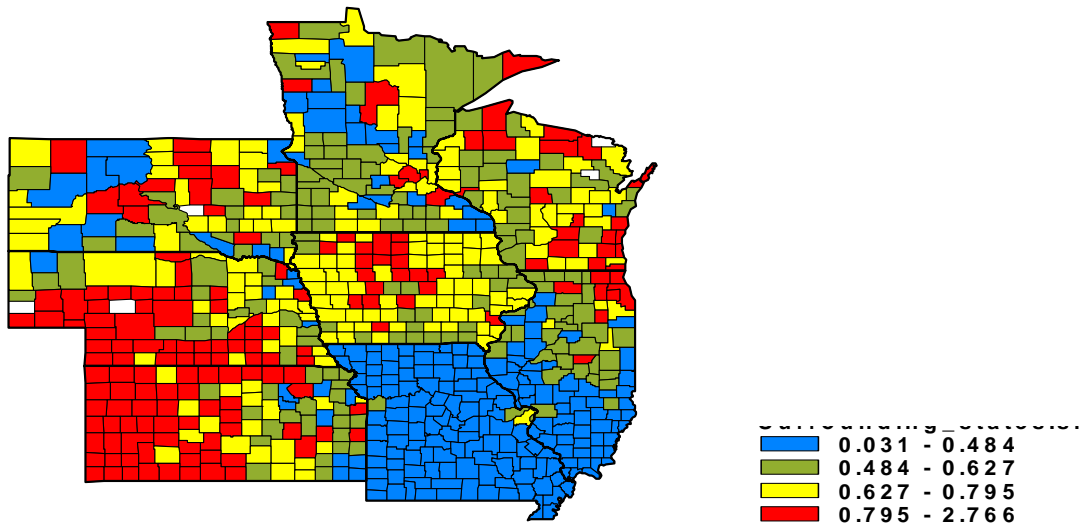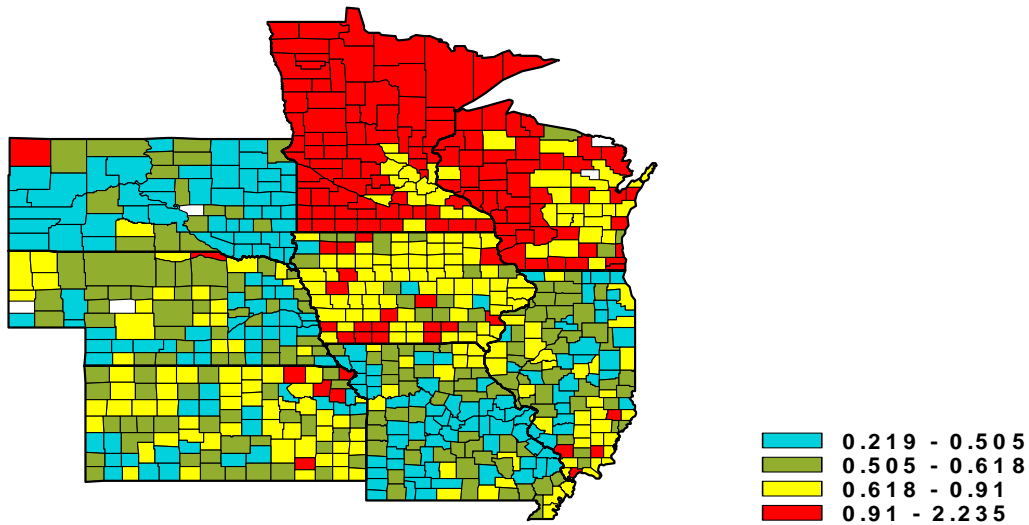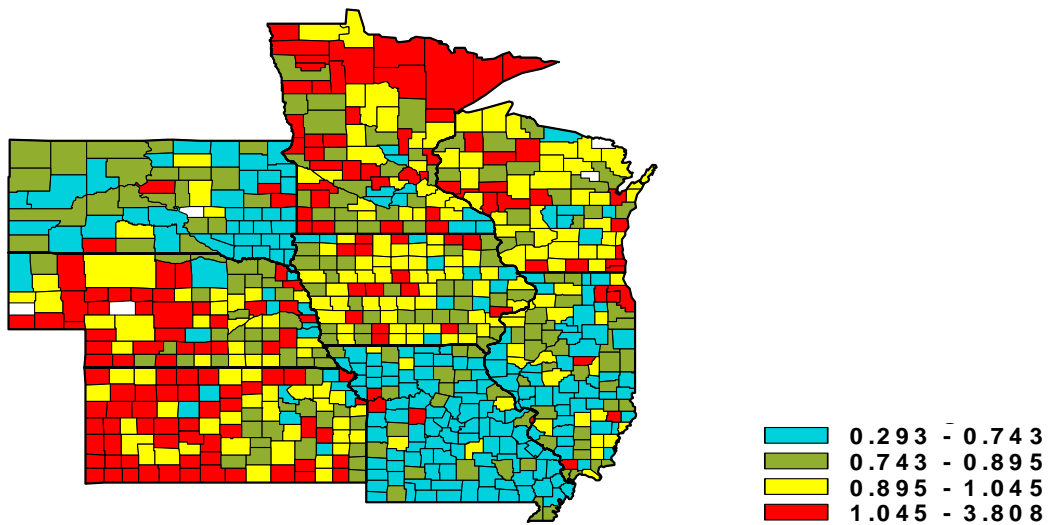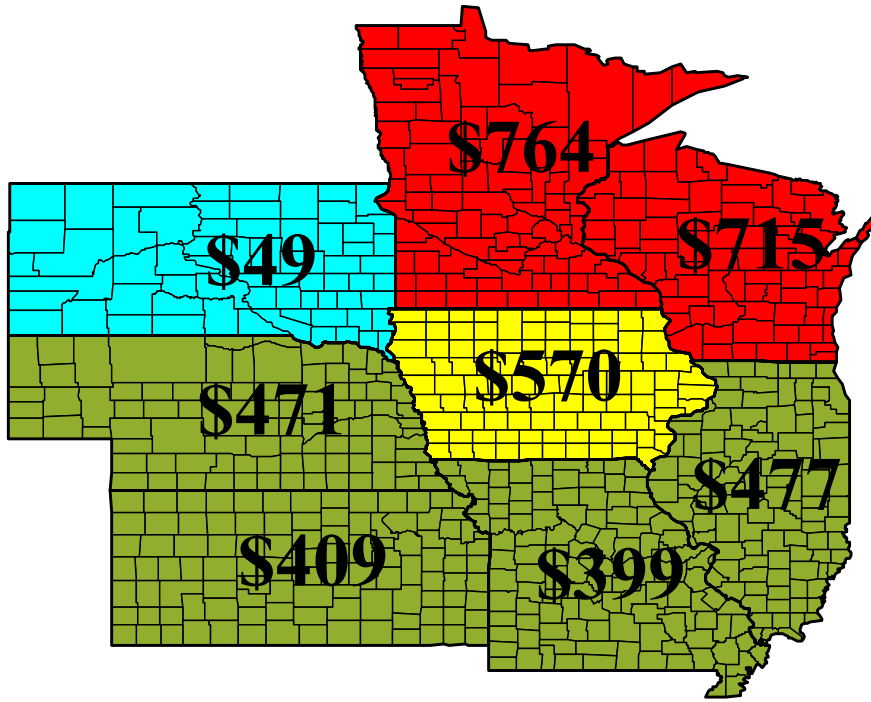| Variable	All States	IA	IL	MN	KS	MO	NB	SD	WI
Total County Income Growth 1990-2001	44.7%	43.3%	47.2%	51.9%	33.6%	55.6%	26.1%	45.0%	57.2%
Per capita Income 1990	$15.69	$16.01	$15.91	$16.25	$16.84	$13.43	$16.54	$15.07	$15.67
Population 1990	45,119	28,048	112,065	50,288	23,596	44,496	16,972	10,546	67,941
Change in Livestock Receipts 1990-2001	-11.3%	-7.3%	-44.2%	-2.7%	-14.1%	-7.2%	-5.2%	6.8%	-7.5%
Amenity Variable - Home County plus nearest 4 counties	19.79	19.23	21.28	23.82	15.32	18.64	16.69	17.64	28.00
COE Swimming Areas - Home plus nearest 4 counties	1.19	0.75	0.68	0.64	1.90	2.56	0.49	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
Transfer Payments Per Capita 1990	$2.49	$2.50	$2.50	$2.55	$2.60	$2.56	$2.31	$2.37	$2.49
Percent of Pop. 65+ 1990	17.4%	18.3%	16.1%	16.5%	18.7%	17.4%	18.8%	17.1%	15.6%
Percent of Population 20-34 1990	20.1%	19.6%	21.7%	20.4%	19.6%	20.6%	18.2%	19.0%	21.6%
Percent of Pop. 25+ with College Degree 1990	13.0%	13.1%	12.8%	13.7%	14.6%	10.8%	13.1%	13.7%	13.4%
Percent of County Income from Farming 1990	8.9%	7.6%	3.0%	7.7%	12.3%	2.6%	20.4%	17.0%	2.9%
Percent of Population commuting 30+ mins 1990	18.6%	16.3%	24.8%	16.8%	16.0%	26.3%	13.9%	11.7%	18.6%
Non-Farm Proprietors Per Capita 1990	0.089	0.090	0.082	0.089	0.106	0.084	0.094	0.088	0.076
Neighboring a Metro County (=1)	17.2%	18.2%	28.4%	17.2%	12.4%	15.7%	11.8%	7.6%	25.0%
County Population 50,000+ (=1) 1990	13.9%	10.1%	26.5%	14.9%	8.6%	13.0%	3.2%	3.0%	33.3%
Interstate within the county (=1)	33.0%	33.3%	52.9%	33.3%	26.7%	34.8%	19.4%	33.3%	27.8%
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

(Note: All dollar values are in 000's of nominal dollars

Table 2 - Regression Results – Local and State Government Variables

| Variable | Regression Model[+] | |
	(I)	(II)
(ln) Per capita Income 1990	-0.0214	-0.0296
	(-0.47)	(-0.64)
(ln) Population 1990	0.0432***	0.0419***
	(5.23)	(4.85)
Change in Livestock Receipts 1990-2001	0.0268***	0.0477***
	(2.73)	(4.76)
(ln) Transfer Payments Per Capita 1990	-0.0213	-0.0226
	(-0.59)	(-0.61)
(ln) Percent of Pop. 65+ 1990	-0.2092***	-0.2611***
	(-5.82)	(-7.13)
(ln) Percent of Population 20-34 1990	-0.1233**	-0.1849***
	(-2.37)	(-3.52)
(ln) Percent of Pop. 25+ with College Degree 1990	-0.0018	0.0114
	(-0.08)	(0.52)
Percent of County Income from Farming 1990	-0.7617***	-0.7487***
	(-9.49)	(-9.24)
(ln) Percent of Population commuting 30+ mins 1990	0.0476***	0.0214*
	(4.03)	(1.86)
(ln) Non-Farm Proprietors Per Capita 1990	0.1167***	0.1103***
	(5.63)	(5.16)
Neighboring a Metro County (=1)	0.0249*	0.0311**
	(1.94)	(2.33)
County Population 50,000+ (=1) 1990	-0.0825***	-0.0862***
	(-4.62)	(-4.64)
Interstate within the county (=1)	0.0053	0.0061
	(0.56)	(0.61)
University Present in the County (=1)	0.0205	0.0215
	(0.51)	(0.51)
Illinois Dummy	-0.0595***	
	(-3.46)	
Kansas Dummy	-0.0277	
	(-1.62)	
Minnesota Dummy	0.0843***	
	(4.02)	
Missouri Dummy	-0.0030	
	(-0.16)	
Nebraska Dummy	-0.0270	
	(-1.47)	
South Dakota Dummy	0.0830***	
	(3.77)	
Wisconsin Dummy	0.0776***	
	(3.83)	

County Amenity Variables		
Amenity Variable - Home County plus nearest 4 counties	0.0023**	0.0054***
	(2.16)	(5.56)
COE Swimming Areas - Home plus nearest 4 counties	0.0031**	0.0035**
	(2.09)	(2.32)
County Tax Variables		
Property Taxes Per Capita 1992	-0.0527***	-0.0438**
	(-2.41)	(-2.12)
Revenue from State Government Per Capita 1992	-0.0728***	0.0438*
	(-2.65)	(1.91)
Government Salaries and Wages Per Capita 1992	-0.0486**	-0.0927***
	(-2.38)	(-4.54)
Composite State Tax Variable - Per Capita		-0.0921**
		(-2.42)
Constant	0.0490	-0.1991
	(0.24)	(-0.99)
R -Square	0.7076	0.6713
Adjusted R-Square	0.6969	0.6621
N	734	734

[+] 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% Change in the Explanatory Variables for the Average Midwestern County

	Mean Values for Entire Sample	Change[+]	Value of Independent Variable in new state	Predicted New Total County Income (000's of dollars)	Resulting Change in Total County Income (000's of dollars)	Resulting Change in Total County Income per capita (1990 Population)
Population 2001	49608					
Total County Income 1990	$ 864,320					
Total County Income 2001	$ 1,517,174					
Income Growth	0.4475					
Per capita Income 1990	15.6913	1.6503	17.3415	$861,762	-$2,559	-$56.71
Population 1990[++]	45119	4745	49865	$867,953	$3,633	$80.51
Change in Livestock Receipts 1990-2001	-0.1129	-0.0119	-0.1248	$868,454	$4,134	$91.62
Amenity Variable - Home County plus nearest 4 counties	19.7875	1	20.7875	$868,996	$4,675	$103.62
COE Swimming Areas - Home plus nearest 4 counties	1.1856	1	1	$867,391	$3,071	$68.06
Property Taxes Per Capita 1992	0.6412	0.0674	0.7086	$860,545	-$3,775	-$83.67
Revenue from State Government Per Capita 1992	0.7021	0.0738	0.7759	$868,117	$3,796	$84.14
Government Salaries and Wages Per Capita 1992	0.9066	0.0954	1.0020	$856,347	-$7,974	-$176.73
Transfer Payments Per Capita 1990	2.4944	0.2623	2.7568	$862,371	-$1,949	-$43.21
Percent of Pop. 65+ 1990	0.1742	0.0183	0.1925	$842,046	-$22,275	-$493.69
Percent of Population 20-34 1990	0.2007	0.0211	0.2218	$848,488	-$15,832	-$350.89
Percent of Pop. 25+ with College Degree 1990	0.1305	0.0137	0.1442	$865,308	$987	$21.88
Percent of County Income from Farming 1990	0.0886	0.0093	0.0979	$858,310	-$6,010	-$133.20
Percent of Population commuting 30+ mins 1990	0.1855	0.0195	0.2050	$866,168	$1,848	$40.96
Non-Farm Proprietors Per Capita 1990	0.0890	0.0094	0.0984	$873,905	$9,584	$212.42
Neighboring a Metro County	0.1719	1	1	$891,639	$27,319	$605.48
County Population 50,000+ (=1) 1990	0.1394	1	1	$792,921	-$71,399	-$1,582.45
Interstate within the county (=1)	0.3302	1	1	$869,607	$5,286	$117.16
University Present in the County (=1)	0.0122	1	1	$883,134	$18,813	$416.97
Composite State Tax Variable - Per Capita	0.4859	0.0511	0.5370	$860,261	-$4,060	-$89.97

[+] All changes reflect a 10% (ln) change from the mean sample value with the exception of dummy variables, the amenity index, and COE swimming areas.

[++] Variables whose estimated coefficients were statistically different from zero with at least a 90% level of statistical significance have been highlighted in the above table