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Three essays on rural economic growth

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Abstract

This dissertation is a collection of three papers, each analyzing a particular issue related to economic growth in rural America. The first paper explores the problem of defining rural and the implications for measuring rural growth. It discusses the sample selection problem inherent in using classification methods based on population that change over time. Fast growing rural areas grow out of their rural status, so using the most recent definition of rural in an analysis of growth excludes the most successful places. The findings demonstrate that average economic performance of the areas remaining rural significantly understates the true performance of rural places and that conclusions about which factors affect growth are sensitive to how rural is defined. The second paper examines the economic consequences of industrial recruitment, focusing on the meat packing and processing industry. Growth in this industry has generated a significant amount of controversy regarding the costs and benefits of this type of economic development. The effects of the industry on social and economic outcomes in non-metropolitan counties of twelve Midwestern states are analyzed using a difference-in-differences approach. Results suggest that as the meat packing industry's share of a county's total employment and wage bill rises, total employment growth increases. However, employment growth in other sectors slows, as does local wage growth. We find no effect on the growth rates for crime or government spending. The final paper analyzes brain drain, the out-migration of young, college-educated workers, which is a serious concern for many rural areas. Existing research on this topic focuses predominately on young adults and does not capture individuals' long-term preferences for locations. This paper employs a mixed logit model to examine the role of college education and location specific capital in rural and urban residence choices of individuals over time. It extends current research in this area by including observations on individuals over time and by recognizing that preferences for rural areas vary in the population. Findings imply that higher levels of education do reduce the probability of choosing a rural residence; however, they suggest preferences for rural locations vary significantly in the population.

General Introduction

Rural America has long been defined by what it is not. It is not urban. What it is is vast, accounting for roughly 95 % of the nation's land base, economically and culturally diverse, and continually changing. Fifty years ago, roughly 40% of the U.S. population resided in rural areas. Today, the proportion is closer to one-fourth, in large part because many rural communities have grown into both small and large cities. Fifty years ago, rural places were nearly all dependent on agriculture. In 1950, the farm population accounted for just under half (46.2%) of the rural population. Today, due to rapid advances in labor saving technology in agricultural production, the farm population comprises a mere 5% of the rural population.

The view of our rural places as a residual has heretofore precluded the creation of much rural policy. Farm policy has been treated as synonymous with rural policy, and when in the past, rural America was united by a common bond of agriculture, this was basically sufficient. Today, however, as agriculture comprises a relatively small and declining share of the rural economy, a new approach is warranted. Rural communities, much like cities, face a myriad of challenges for growing and sustaining their local economies, many of which have little to do with traditional agriculture.

Formulating rural policies is complex. Rural communities are vastly dissimilar. While some rural communities struggle with the population loss, others face the challenge of accommodating an influx of new residents. While some are remote, physically unconnected to larger metropolitan areas, others fight to retain their rural character in the face of development from encroaching cities.

Yet people in rural places across the U.S. do share some common concerns. As they look to the future, they will need to find ways to grow their communities and to manage that growth. They will need to figure out how to provide job opportunities and public services for their residents. And they will need to design effective policies to help ease the transition from a farm based economy.

Much of the existing research on economic growth focuses on macroeconomies: nations or regions. Research on more local economic growth tends to focus on urban economies. While many of the findings from this literature are pertinent to understanding growth in rural areas, there are aspects of rural regions that are unique and interesting in their own right. Studies that do consider rural areas frequently highlight those characteristics of cities that rural communities lack. The basic building blocks for growth, for example, physical infrastructure, human capital, and financial institutions, are necessary whether a community is rural or urban. However, the way in which these building blocks are acquired and utilized will depend on the nature of the community. In addition, rural communities have much to offer that has value because it is distinct from city living: scenic amenities, low crime rates, and affordable housing to name a few.

There is a significant need for more research on the nature and consequences of rural economic growth to inform the process of designing effective rural policies. This dissertation provides a piece of that research, with an aim toward providing an improved understanding of how, where and why economic growth occurs in rural regions of the U.S.

Dissertation Organization

This dissertation is organized into five chapters. This chapter provides an overall introduction and describes the progression of the dissertation. The next three chapters each analyze a particular issue related to economic growth in rural America. While each chapter is meant to stand alone, there are two major underlying themes that tie them together. The first relates to the yet unanswered question: do people follow jobs or do jobs follow people? The second is a question of measurement. How should we define rural? How should we measure growth? By what standards should growth in rural areas be judged? A final chapter provides general conclusions and suggestions for future research.

The problem of defining rural and measuring rural growth is the principle focus of the Chapter 2. This chapter explores the implications of different approaches to defining rural for understanding and measuring rural growth. It discusses the sample selection problem inherent in using classification methods that change over time due to changes in the population. Since the fastest growing rural areas grow out of their rural status, using the most recent definition of what is rural excludes the most successful places from the analysis. The findings demonstrate that average economic performance of the areas remaining rural significantly understates the true performance of rural places. This clouds our understanding of rural growth and may lead to misguided prescriptions for policy.

Chapter 3 examines the economic consequences of industrial recruitment. As agriculture's share of the employment base in rural regions has declined, many communities have sought ways to replace lost jobs by attracting other industries. One of the more prevalent, and controversial, industries to expand into rural areas is the meat packing and processing industry. Growth in this industry has generated a significant amount of debate regarding the costs and benefits of this type of economic development. This chapter investigates the effects of the meat packing and processing industry on social and economic outcomes in non-metropolitan counties of twelve Midwestern states. In contrast to existing research on this topic, which primarily employs a case study approach, this analysis compares the outcomes in industry host counties to outcomes in similar counties without any industry jobs. This approach provides an important frame of reference for measuring impacts and understanding economic change.

The fourth chapter analyzes a separate issue relating to job opportunity in rural areas. Brain drain, the out-migration of young, college-educated workers from the nation's rural areas, poses a serious threat to the social and economic vitality of rural America. Anecdotal accounts from the Midwest to Maine describe an exodus of young, college graduates, lured away by big city living and better-paying jobs. Academic research confirms this, documenting out-migration of rural-born, college-educated youth who are drawn by higher returns to education in urban areas. The loss of skilled workers in rural communities is a particular cause for concern because of the role human capital plays in generating growth.

However, existing research on this topic focuses predominately on young adults shortly after they enter the job market and thus does not capture individuals' long-term preferences for locations. Location may not be a dominant factor in choosing one's first job out of school or preference for locations may change with age. There is less information about the motivations and choices of potential reverse migrants opting to relocate in mid-life. This chapter explores the role of college education and location specific capital in the rural and urban residence choices of individuals over time. It extends current research in this area by including observations on individuals over time and by recognizing that preferences for rural areas vary in the population.

The final chapter provides a summary and some general conclusions.

Reexamining Rural Decline: How Changing Rural Classifications and Short Time Frames Affect Perceived Growth

A paper submitted to the *American Journal of Agricultural Economics*

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Abstract

Beale codes are an important tool for examining rural urban differences in socioeconomic trends. However, as population changes, a county's urban or rural designation may also change. This feature of Beale codes is commonly overlooked by researchers, yet it has important implications for understanding rural growth. Since the fastest growing counties grow out of their rural status, use of the most recent codes excludes the most successful rural counties. Average economic performance of the counties remaining rural significantly understates the true performance of rural counties. This paper illustrates that choice of Beale code can alter conclusions regarding the relative speed of rural and urban growth across a variety of commonly used social and economic indicators. The bias can alter conclusions regarding the magnitude and even the sign of factors believed to influence growth. The use of short time frames such as a single decade to evaluate relative growth across counties can also yield misleading inferences. Therefore, both academicians and policy-makers must be careful to use appropriate Beale code designations and time frames in evaluating prescriptions for rural growth.

Introduction

Beale codes, or rural-urban continuum codes, are an important tool for researchers interested in examining differences in socioeconomic outcomes between metropolitan and nonmetropolitan areas. However, as population changes, counties' designations also change over time. This feature of Beale codes is commonly overlooked by researchers, yet it has important implications for understanding rural growth. The most successful rural counties in

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terms of population growth will grow out of the rural designation and become urban or metropolitan counties. At the same time, the least successful urban counties may lose enough population to change to rural status. The fact that counties' status as rural or urban are re-evaluated with each new census creates a sample selection problem when analyzing patterns of population and economic growth over time. If rural status is determined by the most recently reported Beale codes, average rural population growth will be seriously understated as the fastest growing rural counties are selected out of and the slowest growing urban counties are sorted into the rural group. Similar downward bias occurs in measured employment and income growth.

We show that conclusions regarding which factors influence growth are also sensitive to the choice of Beale code. Specifically, the implications of local tax and expenditure policies and the role of location and demographics change when end-of-period Beale codes are used rather than start of period Beale codes. Furthermore, coefficients used to assess which factors affect growth are not stable across decades, suggesting that single cross-sectional analysis of decadal growth can yield misleading inferences regarding the rural growth process. Therefore, both academicians and policy-makers must be careful to use appropriate designations of rural status in evaluating and formulating prescriptions for rural growth.

These biases are more than just a matter of statistical curiosity. The exaggerated decline in rural population, employment and income growth has been used to justify numerous government programs designed to stem the tide of the rural decline. For example, recently proposed Federal legislation recommends government provision of venture capital and tax incentives for individuals and businesses to locate in rural areas. These incentives are designed to counter decades of decline in jobs and population that have resulted in the, "decimation of America's Heartland."[1] While population loss is a very real and serious problem for some rural counties, our analysis shows the demise of rural America has been significantly overstated.

This paper illustrates how conclusions about growth in rural areas of the U.S. change depending upon when rural status is defined. In addition, we explore the possibility that results from statistical growth analyses are sensitive to the sorting problem created by reclassifying counties' status as rural or urban each decade. By excluding the most successful counties from the sample, use of end-of-period designations discards valuable information from the very counties from which we have the most to learn. Finally, we investigate whether short time frames affect conclusions regarding growth.

Defining Rural Status

Rural-urban continuum codes classify counties into categories based on population data from the U.S. census and, for nonmetropolitan counties, based on geographic proximity to metropolitan areas. They were developed by staff at the Economic Research Service in the mid-1970s in order to provide a more meaningful designation than was possible using rural/urban or metro/nonmetro splits (Hines, et al, 1975). The codes were updated in 1983 to reflect population changes between the 1970 and 1980 Censuses and again in each succeeding decade to reflect the most current Census data. While the classification categories have remained constant over time, definitional changes have altered how counties are classified.[2] For example, in the 1974 classification, counties were considered adjacent to a metro if they had a border contiguous to an SMSA and at least one percent of the county's population commuted to the metro's central county for work. The condition for adjacency was altered in later versions of the codes, requiring that at least two percent of the employed labor force commute to the metro's central county.[3] Table 1.1 provides a description of the coding system. We will reference the codes by the Census year upon which they are based (1970, 1980, 1990, 2000). We recognize that while all rural counties are nonmetropolitan, not all nonmetropolitan counties are rural. Nevertheless, many people use the terms rural and nonmetropolitan interchangeably. Throughout this paper we define rural counties as types 8 and 9, counties classified as nonmetropolitan, completely rural.

Table 1.2 shows the number of counties by 1970 and 2000 rural-urban continuum codes. Each row corresponds to a 2000 Beale code designation with the final column reporting the total number of counties in that 2000 category. Reading across each row reveals the distribution of 1970 county types for a particular 2000 code. For example, the first row (2000 type 1) shows that of the 410 metropolitan counties with over 1 million in population in 2000, 182 were also type 1 in 1970, 91 were type 2 in 1970, 8 were type 3, and so on. Each column corresponds to a 1970 rural-urban continuum code with the bottom row reporting the total number of counties in that 1970 category. Reading down each column shows the distribution of 2000 codes for a particular 1970 designation. For example, reading down the column labeled 1970 type 9 shows that of the 616 completely rural, nonadjacent counties in 1970, 4 were categorized as type 1 in 2000, 5 as type 2, 20 as type 3, and so on. Gray shaded cells on the diagonal indicate the number of counties in each code that had the same classification in both time periods.

The bottom section of table 1.2 shows the percent of counties that retained the same classification or changed classification from their 1970 category. Moving up in the classification means attaining a code with a smaller number (i.e. increasing urban population). Cells to the northeast of the shaded diagonal display the number of counties moving up in each code. Cells to the southwest of the shaded diagonal display the number of counties moving down in the classification scheme (toward a higher number, less urban population).

More than 40% of the counties (1,339 counties) were classified differently in 2000 than in 1970. Of the counties that changed classification, 92% or 1,228 counties moved "up" in classification. In general, moving up means gaining population; 89% of the counties that moved up in the classification scheme experienced population increases between 1970 and 2000. Only 111 counties moved "down" in the classification scheme. Of those moving down, 41% lost population.[4] Of the 857 counties categorized as nonmetropolitan, completely rural in 1970 (types 8 or 9), 368 or 43% moved up in the continuum. About one-third of these most rural counties moving up the continuum grew so much that they were classified as metropolitan by 2000. In total, 464 counties or about one-fifth of the nonmetropolitan counties (codes 4 through 9) became metropolitan counties (codes 1 through 3) by 2000. While most of these were adjacent to a Standard Metropolitan Statistical Area (SMSA) in 1970, about one quarter (118) were categorized as non-adjacent. Clearly, there is sufficient movement across classifications that results could be sensitive to the choice of start-of-period versus end-of-period classifications.

In the study that first used the Beale codes, Hines, Brown and Zimmer (1975) analyzed changes in county social and economic characteristics between 1960 and 1970. The authors recognized the potential problem in using the 1970 classification scheme for their analysis in that "...nonmetro rates of change between 1960 and 1970 for a number of items may be depressed by the inclusion of some rapidly changing counties in the metro category that were nonmetro at the beginning of the period (1960). With respect to population growth, for example, newly designated metro counties grew by 25.3 %, compared with 16.4 % for those that were metro in both 1960 and 1970 and only 4.4 % for those that were nonmetro at both times" (pp. 4). Nevertheless, they did not adjust their analysis to incorporate a measure of metropolitan status as of 1960.

Subsequent research has also recognized the problem of changing metropolitan status and its implications for understanding population trends. Fugitt, Heaton and Lichter (1988) presented alternative methods for computing nonmetropolitan and metropolitan population growth rates over time, using county level data. Their analysis revealed significant differences in the nonmetropolitan growth rate depending upon the method and definitions applied. For example, they reported nonmetropolitan population growth rates from 1970 to 1980 ranging from 0.2 % (allowing designations to change over time) to 20.4 % (with a constant area approach). For the decade of the 1960s, their estimates of nonmetropolitan growth rates varied from a 10.9 % increase to a 13.2 % decline. Despite the large changes in magnitude and even changes in sign, they concluded that "[a]ny differences in substantive conclusions across the various approaches appear to be largely a matter of degree rather than kind" (pp. 126).

Even the researchers who acknowledge the problem of changing metropolitan classifications often fail to correct for the problem. Johnson (1989, pp.303) stated that "any effort to examine longitudinal nonmetropolitan demographic trends must address the issue of metropolitan reclassification," illustrating that the use of end of the period rather than start of period classifications reduced the nonmetropolitan growth rate between 1980 and 1987 by 32 %. Nevertheless, he applied the 1970 classification to designate nonmetropolitan status for his analysis of historical trends in population growth between 1930 and 1970.

Fugitt, et al.'s and Johnson's concern about the potential for changing metropolitan classification to produce misleading inferences about demographic trends has been largely forgotten in the recent literature. An exception is a 2001 article by Andrew Isserman that distinguishes between rural and formerly rural counties. Isserman illustrates how dramatically conclusions about rural population growth and economic success change when rural is defined by the set of counties classified as nonmetropolitan in 1950 relative to a definition of rural based on the 2000 Census. "Today, some 71 million people, one-fourth of the U.S. population, live in what was rural America in 1950 but is considered urban America today" (pp. 41).

A number of recent articles appearing in leading academic journals with a rural development focus examine metro/nonmetro differences in social and economic trends (See Appendix for a list of these articles). Most use Beale codes to classify areas or individuals as rural/urban or metro/nonmetro, yet in most the timing of the classification scheme is not discussed. Of nineteen articles identified, four used beginning-of-period codes, eight used end-of-period codes, six did not identify the code used, and one allowed a county's status to change over time.

When authors use the metro/nonmetro status reported by the government, they will, often inadvertently, be using the most recent code vintage. For example, three of the studies mentioned above used longitudinal data from the Current Population Survey (CPS) in which an individual's residence is classified as metropolitan or nonmetropolitan. The CPS uses current Beale code designations, effectively allowing rural status to change over time. Since a county may change status over time, an individual in the survey may migrate from rural to nonmetropolitan to metropolitan areas without changing residence.[5] These seemingly minor points can lead to very misleading conclusions about changes in rural areas. For example, it is readily assumed that declining rural population has resulted from people moving out of rural areas and into the cities. Yet, one-third of 1950 rural residents have become urban dwellers without leaving home (Isserman, 2001).

Measuring Rural Growth

How rural is defined has important implications for measuring growth. Total U.S. population increased 38% between 1970 and 2000. Population in the set of counties defined as rural in 1970 grew 41% between 1970 and 2000, faster than the national rate. Population in those counties classified as rural in 2000 grew only 13% over this period, about one-third as much as the national increase. Clearly, these two figures paint very different pictures about rural growth over the past three decades.

The following section illustrates how measures of rural growth change depending upon which vintage of Beale codes are used to classify counties.

Population Growth

Table 1.3 presents the average population growth for U.S. counties classified by 1970 and 2000 rural-urban continuum codes. The shaded cells indicate the average for counties that did not change classification over that period. Cells to the southwest of the shaded diagonal display average growth rates for counties that moved down the classification scheme. For example, 1970 type 7 counties that became type 9 counties in 2000 suffered an average population loss of 13.6 %. Cells to the northeast of the shaded diagonal display average growth rates for counties that moved up in the scheme. For instance, counties that were classified as type 9 in 1970 but changed to type 7 in 2000 grew on average 95.5 %. Bolded numbers indicate that the average population growth for counties in that off-diagonal cell is significantly different from the shaded number in that column showing the average growth of counties that were in the same classification in 1970 but did not change type.

The average population growth for all counties was 43.4% from 1970 to 2000. In general, counties that moved up the classification scheme experienced faster population growth and counties that moved down in the classification scheme grew more slowly when compared to counties whose type did not change. For six of the nine county types, use of the 2000 classification understates population growth. Using the 2000 codes, one would conclude that the average population growth for rural, non-adjacent counties (type 9) was 4% when in fact, average population growth in these counties was more than six times that rate, 25.4%, over the 1970-2000 period. Using the 2000 codes not only excludes those type 9 counties which grew enough to be re-classified between 1970 and 2000, but it also includes those counties that moved down to type 9, in many cases because they suffered population losses.

Similarly, the growth rate for completely rural adjacent counties (type 8) was more than twice as large (70%) than would be reported using the 2000 codes (27%). For three of the nine county types (2, 4, and 5), population growth is overstated when the 2000 codes are applied. Population in the largest nonmetropolitan, non-adjacent counties (type 5) grew on average 31% from 1970 to 2000. When the 2000 codes are used, however, the implied growth rate was 41%, as fast-growing, formerly rural counties are added to the type 5 group.

Population more than doubled in 390 counties between 1970 and 2000. Over half of these (231) were designated nonmetropolitan in 1970, with about one-fourth (103) classified as completely rural. Of this set of fastest growing counties, two-thirds changed Beale code designation, moving up in the classification scheme. Proportionately more of the partly urban, nonmetropolitan (84%) and completely rural nonmetropolitan (80%) counties in this set moved up in the continuum. More than half of the completely rural counties in this group (55 of 103) lost their rural status by 2000. Likewise, 69 of the 128 partly urban, nonmetropolitan counties had become metropolitan by 2000.

Employment Growth

Table 1.4 shows the average employment growth for counties using both the 1970 and 2000 classification schemes. We measure employment growth as the percent change in total full-time and part-time employment from 1970 to 2000 using data from the Bureau of Economic Analysis' (BEA) Regional Economic Information System. The layout for table 1.4 is similar to table 1.3.

These data display a pattern similar to that in table 1.3. Counties that moved up in the classification scheme experienced faster average employment growth relative to counties that did not change type. Counties that moved down in the scheme grew more slowly. Employment growth averaged 89.2% for all U.S. counties over the 1970 -2000 period. When the 2000 codes are used to classify the counties by type, it appears that metropolitan (types 1-3) and the most urban nonmetropolitan counties (types 4 and 5) all experienced employment growth at or above the national average. In contrast, employment growth in the less urban nonmetropolitan and rural counties lagged behind the national average. When the 1970 codes are used, however, a somewhat different picture emerges. Non-adjacent nonmetropolitan counties with an urban population of 20,000 or more (type 5) had below-average employment growth over the period. Rural counties adjacent to a metropolitan area (type 8) grew considerably faster than the national average. Employment growth in rural non-adjacent counties (type 9), while still below average, was substantially larger (65.6% versus 36.2%) when the 1970 codes are used.

Real Income Growth

The average real income growth rates by county type are shown in table 1.5. County aggregate personal income data are obtained from the BEA. These data were adjusted for inflation using the Consumer Price Index – Urban Wage Earners and Clerical Workers from the Bureau of Labor Statistics. The percent change in real total personal income was calculated from 1970 to 2000. Real county personal income grew 144% on average over the time period. Counties that moved up the classification between 1970 and 2000 experienced significantly larger increases in real personal income than did counties whose designation did not change. Use of the most recent classification scheme overstates income growth for four of the nine categories (types 1, 2, 4 and 5) and understates growth for the remaining five (types 3, 6, 7, 8, and 9).

Income growth for counties designated as rural in 1970, but classified as urban or metropolitan in 2000 experienced above average income growth. The omission of these counties from the rural category results in a significant understatement of rural county income growth over the time period. Based on the 2000 codes, income growth in type 8 and 9 counties was 112% and 72%, respectively. When the 1970 codes are applied, rural income growth is considerably greater at 182% and 112%.[6]

Table 1.6 summarizes the differences in average growth rates using the 1970 and 2000 Beale codes reported in tables 3-5. To illustrate how to read the table, the average population growth for type 1 counties according to the 1970 classification was 110.7% compared to 104.1% using the 2000 classification. The difference is -6.6%, suggesting that the use of 2000 Beale codes biases downward the implied population growth of the largest counties. The t-statistic shows that the bias is not statistically different from zero.[7]

For six of the nine county designations, the direction of the bias is consistent across all three growth indicators. For rural areas, the bias is large, negative and significant. For metropolitan areas, the bias is most often negative but small and never statistically significant. The direction of bias varies for nonmetropolitan urban counties. Most noticeably, growth is consistently inflated in type 5 counties when the 2000 designations are used.

The implication of table 1.6 is that rural growth is consistently understated relative to its true value when end-of-period rural designations are used. Use of the 2000 Beale codes sorts out the fastest growing rural counties and sorts in shrinking urban counties. The bias in measured rural growth is very large, ranging from 22% to 70% depending on growth measure and county type. Use of the 2000 designations leads to the false conclusion that rural counties have much slower than average growth, however measured. Use of the 1970 designations reverses these conclusions.

Regression Analysis of the Determinants of County Growth

In addition to creating problems in reporting and analyzing trends for metropolitan and nonmetropolitan counties, changing Beale code classifications may also have implications for assessing the determinants of growth. To illustrate, we estimated a reduced form version of the Carlino and Mills (1987) model, regressing the rural county growth rates described above on human capital measures, policy variables, and environmental factors commonly used in this literature[8,9].

Carlino and Mills present a model in which equilibrium employment and population are simultaneously determined. They begin with a spatial general equilibrium model in which both households and firms are geographically mobile. Households seek to maximize utility, which in its indirect form is a function of wages, rents and a mix of other site-specific characteristics such as non-market amenities and local fiscal policies. Local taxes are expected to reduce utility since a higher tax incidence reduces both consumption expenditures and government services.

Firms maximize profit, which depends on wages, rents and other site specific attributes. Firm productivity varies across locations due to regional differences in labor supply, transportation costs, agglomeration economies and local fiscal policy. Interregional movement of firms and households occurs until utility levels and profit levels are equalized across locations.

Equilibrium levels of employment and population, E* and P*, are functions of county employment, E, and county population, P, as well as a vector of partially or fully overlapping exogenous location specific attributes S and T. These vectors include variables such as climate, crime rates, human capital stocks and local fiscal policy.

$$E^* = \alpha_E P + \beta_E S \qquad (1)$$

$$P^* = \alpha_P E + \beta_P T \qquad (2)$$

Deller, et al. (2001) expand the model by explicitly including income:

$$E^* = \alpha_{1E}P + \alpha_{2E}I + \beta_E S \tag{1'}$$

$$P^* = \alpha_{1P}E + \alpha_{2P}I + \beta_P T \tag{2'}$$

$$I^* = \alpha_{1I}P + \alpha_{2I}E + \beta_I Z \tag{3}$$

where Z is a vector of exogenous location- specific attributes. Population, employment and income are assumed to adjust their equilibrium levels with substantial lags:

$$E_t = E_{t-1} + \lambda_E(E^* - E_{t-1}) \tag{4}$$

$$P_t = P_{t-1} + \lambda_P(P^* - P_{t-1}) \tag{5}$$

$$I_t = I_{t-1} + \lambda_I(I^* - I_{t-1}) \tag{6}$$

where the subscript t references time periods and λ_E, λ_P and λ_I represent speed of adjustment parameters. Bringing the lagged values of E, P and I to the left-hand side of the equation and substituting for their equilibrium values yields the following three equation system:

$$\Delta E = E_t - E_{t-1} = -\lambda_E E_{t-1} + \lambda_E\alpha_{1E}P + \lambda_E\alpha_{2E}I + \lambda_E\beta_E S \tag{7}$$

$$\Delta P = P_t - P_{t-1} = -\lambda_P P_{t-1} + \lambda_P\alpha_{1P}E + \lambda_P\alpha_{2P}I + \lambda_P\beta_P T \tag{8}$$

$$\Delta I = I_t - I_{t-1} = -\lambda_I I_{t-1} + \lambda_I\alpha_{1I}P + \lambda_I\alpha_{2I}E + \lambda_I\beta_I Z \tag{9}$$

In reduced form, the model becomes:

$$\Delta E = \gamma_{0E} + \gamma_{1E}E_{t-1} + \gamma_{2E}P_{t-1} + \gamma_{3E}I_{t-1} + \delta_E X \tag{7'}$$

$$\Delta P = \gamma_{0P} + \gamma_{1P}E_{t-1} + \gamma_{2P}P_{t-1} + \gamma_{3P}I_{t-1} + \delta_P X \tag{8'}$$

$$\Delta I = \gamma_{0I} + \gamma_{1I}E_{t-1} + \gamma_{2I}P_{t-1} + \gamma_{3I}I_{t-1} + \delta_I X \tag{9'}$$

where population, employment and income growth are functions of the lagged values of these measures and X is the union of S, T and Z. We estimate the reduced form model under different Beale code regimes to examine if the results are sensitive to the choice of start-of period or end-of –period rural status. The reduced form parameters γ represent the effect on the equilibrium values of E, P and I from a change in the exogenous regressors after all feedback effects have occurred.

The exogenous variables are summarized in Table 1.7. We include 1970 measures of population, employment and income in natural logs to control for initial conditions and to examine whether growth among rural counties tends to converge or diverge. The log of population in 1970 and the log of employment in 1970 are highly correlated ($\rho = 0.92$) ; therefore the log of 1970 employment is excluded from the population and income growth regressions, while the log of 1970 population is excluded from the employment growth regressions. Amenity measures obtained from the USDA's Economic Research Service are used to control for time invariant climatic differences across regions. We use start-of-period values for the percent of the county population with a high school degree and percent with a college education or higher to measure initial human capital endowments. Start-of-period values of the percent of the population aged sixty-five or older and the percent non-white are included to measure demographic characteristics that may affect both labor supply and local demand for goods and services. Start-of-period local government expenditures and taxes per employee measure variation in local fiscal policy that may deter or encourage growth. We include regional dummies as well as the natural log of the county area in square miles to control for variation in county size across the U.S. A dummy variable indicates adjacency to a metropolitan area.

The dependent variables are log differences of county population, employment and aggregate income between 1970 and 2000. The latter can be viewed as a proxy for growth in aggregate county production over the period. For each case, we defined the sample of rural counties in two ways. Figure 1 shows the geographic distribution of the two samples The first, based on the 1970 Beale code definitions, results in a sample of 847 rural counties. These counties are shaded in red and blue. The second, derived from the 2000 codes, produces a sample of 654 rural counties. These counties are shaded red and yellow in figure 1.1.

Table 1.8 reports the regression results. The first column reports the regression results for the population growth equations using the 1970 definitions to define the sample of rural counties. The second column reports the results of the same regression using the 2000 definitions to define the sample. The third column reports the level of significance of a test of the difference between the coefficients in each equation.[10] In addition, we computed a joint test of the null hypothesis that all coefficients were equal across the two regressions. The F-test statistic is reported in the bottom row of the table. Columns 4-6 report similar results for the employment growth equations. Results for the income growth equations appear in columns 7-9.

In all cases, the null hypothesis that the coefficients are equal across the regressions based on the 1970 and 2000 rural definitions was easily rejected. There are notable differences in the magnitudes and significance levels of coefficients between the two samples. One important difference between the two sets of regressions is the estimated effect of local fiscal policies on growth. Higher expenditures raise population and employment growth significantly using either rural sample, but higher taxes have a significant impact only when the 2000 sample is used. In the case of income growth, use of the 2000 sample yields the counterintuitive result that higher taxes raise income growth, while higher expenditures deter it.

Conclusions regarding proximity to a metro market are also sensitive to the choice of rural definition. Using the 1970 definition shows that metropolitan adjacency is extremely important for rural population and employment growth. In contrast, using the 2000 Beale code rural sample suggests that adjacent counties experienced relatively slower growth. Regional growth patterns also change between the two samples. Using the start-of-period sample implies that rural counties in the northeastern U.S. experienced relatively faster population and employment growth compared with counties in the central part of the country. Use of the end-of-period sample suggests that western counties grew relatively faster, while northeastern counties lagged those in the Midwest. In general, however, these coefficients are not statistically different across equations.

The role of a rural county's age and race composition differs between the two samples as well. End-of-period estimates overstate the downward pressure higher proportions of non-white residents or elderly residents have on population and employment growth, while understating the effects of these populations on income growth.

Some conclusions about the data do not change drastically as a result of changing Beale code classifications. The role of human capital, measured by $College_{70}$, and $HighSchool_{70}$ is jointly positive and significant in both the population and employment growth equations, regardless of which designation is applied. The sign of the coefficient on $College_{70}$ in the income growth regressions switches from positive in the 1970 sample to negative in the 2000 sample, but is insignificant in either case.

The various amenity measures generally have consistent signs and significance across the two samples in directions conforming with presumptions. Areas with more sunny days and warmer Januaries have faster growth, as do areas with cooler Julys and less humidity. Using the 1970 sample, more mountainous areas (higher values of topography) have no significant advantage for growth, while the 2000 sample would suggest these counties have experienced faster employment and income growth. Use of the end-of-period sample also suggests that more humidity leads to faster growth, although the effect is only significant in the employment equation.

The potential problem of sample selection for establishing convergence or divergence in growth is well recognized in the literature on convergence among countries. Studies reporting income convergence across nations by William Baumol (1986) and Angus Maddison (1983) were criticized for using an *ex post* sample of countries. The selection of successful, rich countries at the end of the period essentially guaranteed convergence among these counties since they were either rich to begin with or they caught up and became rich. Furthermore, any countries which may have begun rich but fell behind are excluded from the sample.[11] This analysis provides an analogous situation in which sorting might lead to artificial evidence of convergence. Counties considered rural in 2000 either have not grown since 1970 or have become rural because they lost population since 2000. Meanwhile, counties which grew out of their rural status are, by definition, excluded from the sample.

In this analysis, sorting does not appear to lead to artificial evidence of convergence. However, end-of-period samples do understate the magnitude of divergence that occurred in all three measures of growth. Counties with higher initial levels of population have faster population growth using either rural sample, although the coefficient shrinks in sign and significance using the 2000 sample. A similar pattern holds for the employment and income growth equations, although the coefficients in the income growth regressions are much closer in magnitude.

Regression Analysis by Decade

The regression results in table 1.8 show that growth in rural counties tends to diverge over time. This raises an interesting question regarding the appropriate length of time for studying growth. Of the recent journal articles examining metro/nonmetro trends we identified, about one-third analyzed a time period spanning a decade or less. If lagging counties tend to grow faster, growth over a short period may yield misleading information regarding relative growth across counties. In contrast, if county growth rates exhibit trend stationarity, counties experiencing growth in one decade would experience continued growth in the following decade.

Table 1.9 reports the correlation between decades for population, employment and real income growth in rural counties. Rural status is again defined in two ways: by the 1970 designation and by the 2000 designation. The evidence that growth begets growth in rural counties is quite weak. Population growth exhibits the strongest positive correlation between decades. Using the 1970 designations for rural counties, the correlation coefficients are 0.66 between the 1970s and the 1990s and 0.70 between the 1980s and 1990s. The relationship between county employment growth rates from one decade to the next is only weakly positive. For real income growth, there is also only weak correlation in the changes from one decade to the next. For all three measures, the correlation between the 1970s and 1990s is as strong or stronger than the near term correlations. The correlations suggest that population growth from one decade to the next may persist, but that employment and income growth in any one decade may not be indicative of growth in other decades.

Table 1.9 shows that regression results can vary by the length of time over which growth is measured, particularly for employment and income growth. We repeat the Carlino and Mills specification outlined above using growth rates and data defined over a decade rather than over a thirty year period. Table 1.10 shows that the coefficients are indeed unstable across decades. The sample is the set of counties designated as rural at the beginning of each decade.[12]

The table is divided into three sections corresponding to the three measures of growth: population, employment and real income. The first column in each section reports the Carlino and Mills reduced form regression for 1970 to 1980; the second for 1980 to 1990; and the third for 1990 to 2000. The fourth column reports the test statistic of the null hypothesis that the coefficients are equal across the three decades. In each regression, the "baseline" variables are defined at the beginning of the decade. For example, county population in 1970 is used to measure the natural log of population in the regression for the 1970s, while county population in 1980 is used in the 1980s regression and county population in 1990 is used in the 1990s regression. The amenities variables are constant across decades.

In both the population growth and employment growth regressions only five of the eighteen coefficients retain sign and significance across decades. Higher initial levels of population increase population growth every decade as do warmer Januaries and cooler Julys. Population grew faster in counties adjacent to a metropolitan area. The signs and significance of these coefficients are consistent with the results from the 30-year growth equations using beginning-of-period designations, but not always with those using end–of-period designations. For example, adjacency is associated with negative population growth in the 30-year regression using the 2000 sample. Average temperatures and adjacency matter each decade for employment growth. The proportion of county residents over age sixty-five is significantly negative each decade, while in the 30-year regression using the 1970 sample, it is about one-fifth the size and insignificant. None of the coefficients maintain significance across the three decades in the income growth regressions.

Even for the more reliable employment and population growth equations, the signs and significance of many of the variables change from decade to decade. For example, there is no consistent implication regarding the effect of local fiscal policy variables. In the 1970s, the results suggest that expenditures per capita had a positive and significant effect on both population and employment growth. The effect of taxes per capita is negative but insignificant in both cases. In the 1980s, expenditure levels still have a positive and significant effect on employment growth, but the coefficient falls by about one-third compared with the 1970s. Taxes have a small, but significantly negative impact on employment growth in the 1980s. By the 1990s, neither variable seems to matter much: they are small and insignificant. The joint test of coefficient stability across decades is rejected for expenditures per capita in both the population and employment equations.

Other measures generally retain their signs across the three decades, but the significance levels vary across decades. The coefficient on the proportion of residents with a college education is positive in all nine regressions, but only significant in only four. It is half as large or smaller in the later decades relative to the 1970s in both the population and employment growth equations.

The goodness of fit measures for the 30-year growth equations using the start of period sample are as high or higher than those in the decade by decade regressions. Using end-of-period samples, the goodness-of-fit is always worse.

The 1970s regressions most closely resemble the 30-year regressions using the beginning-of-period sample. These sets of equations use the same sample of counties. As the set of rural counties changes each decade, conclusions about which factors are relevant for growth change as well. Because the later samples select out those most successful counties that grew enough to lose their rural status, these samples omit valuable information about which rural counties grew and why. These results suggest that cross-sectional studies of rural growth that rely on a single decade of data can yield misleading inferences regarding the magnitude and sign of the effects of various factors on long term rural growth.

Conclusion

This analysis illustrates the potential for bias when analyzing rural and urban differences over time. Using end-of-period designations to define rural significantly understates the economic performance of rural counties over the past three decades. Population growth between 1970 and 2000 in the most rural counties is understated by 22% or more when 2000 designations instead of 1970 designations are used to define the set of rural counties. Average employment growth is underestimated by 30 percentage points or more and average income growth by more than 40 percentage points.

Furthermore, the choice of Beale code vintage can alter conclusions about which factors affect growth. In particular, conclusions about the role of fiscal policies, location and demographics change depending on how the set of counties is defined. Divergence in population and employment growth among rural counties is significantly understated when the end-of-period sample is used, since counties that grow the fastest are excluded from this sample.

We also find that the choice of time frame for the analysis may alter the findings. We find little evidence among rural counties that growth begets growth, especially when measuring changes in employment and income. Furthermore, we find inconsistency across decades in the factors that are important for explaining growth.

Some findings are consistent across specifications and do not appear to be affected by either the vintage of Beale code or the time frame of the analysis. More populous counties experience faster population growth. Amenity-related measures are generally consistently significant across specifications. But these are factors not easily altered by policy. Conclusions regarding the role of factors that policy can affect do change according to the specification. For example, beginning-of-period sample results suggest that providing higher levels of public services is more important for population and employment growth than minimizing tax burdens. Also, in the beginning-of-period sample, proximity to metropolitan areas matters. This suggests that transportation policies to improve rural residents' access to urban markets might spur growth. Both these policy implications are weakened or even reversed when end-of-period samples are used.

Understanding how and why economic growth occurs in rural America is a challenging, yet vital part of designing effective policies at both the federal and local level. Confounding this challenge is the fact that the most successful rural counties are no longer rural. If these counties are ignored in analyzing factors that help rural counties grow, we are disregarding the very group of counties that offers the most successful cases. If instead, we define rural status at the outset, we obtain both a more encouraging outlook regarding the prospects for rural growth and better information regarding the factors that can lead to rural expansion.

Endnotes

[1] Quoting the web site of Senator Byron L. Doran. The news release supporting the New Homestead Act contends that, "nearly 70% of rural counties on the Great Plains have seen their populations shrink by an average of about a third." That statistic should more accurately be stated as, "70% of counties remaining rural ...have experienced population decline." See http://dorgan.senate.gov/legislation/homestead/homesteadbrochure.pdf.

[2] The only exception is that in the most recently released Beale codes, the central and fringe counties of major metropolitan areas (types 0 and 1) have been consolidated into one category. To make our results comparable over time, we aggregate classifications 0 and 1 into a single class.

[3] Another noteworthy definitional change occurred with the latest Beale Codes. In the 2000 Census, a significant revision was made in how rural and urban boundaries were defined, thereby changing the definition of urban population that is applied in the classification scheme. Prior to 2000, the criteria for defining urban areas were based on a population threshold for places. In 2000, the criteria are based on population density of census blocks and block groups. One effect of this change is that cities, which previously had no rural population by definition, may now be comprised of both rural and urban residents. For example, in Des Moines, Iowa, 100% of the population was designated as urban in 1990; in 2000, 1,155 residents (0.6% of the city's population) were classified as rural.

[4] A county can move up the classification scheme without gaining population if a bordering county grows into a metropolitan area. Similarly, a county can move down the classification scheme despite gaining population if a bordering county changes from metro to nometro status.

[5] There is no obvious way to correct for changing rural designations in time series evaluations of the CPS data because county of residence is not identified.

[6] This is in marked contrast to conclusions based on contemporaneous measures of rural that show steadily widening gaps between urban and rural incomes (Ghelfi, 2002).

[7] Use of beginning-of-period and end-of-period metropolitan status defines two different samples of rural counties, which can be viewed as a sample selection or sorting problem. Use of a t-test to determine statistical significance is appropriate given this view of the data.

[8] In their empirical analysis of the determinants of growth, Barro and Sala-i-Martin model a country's per capita growth rate, in period t, dy_t as $dy_t = F(y_{t-1}, h_{t-1}, x_{t-1} \ldots)$ where y_{t-1} is initial per capita GDP, h_{t-1} is initial human capital per person and x_{t-1} is an vector of policy and environmental influences (p. 421). Deller, et al, (2001) estimate a reduced form version of the Carlino and Mills model to assess the role of amenities on rural economic growth. They regress growth rates of population, employment and per capita income on measures of markets, labor, government and amenity attributes.

[9] These regressions are designed to explore whether the results are sensitive to the sorting arising from the choice of beginning-of-period or end-of-period Beale codes. While we have attempted to include measures typically used in the growth literature, we recognize that there is disagreement as to the most appropriate model for describing economic growth. In particular, a number of recent papers model spatial interactions explicitly. Such treatment is beyond the scope of this paper.

[10] To conduct this test, we created a dummy variable which took a value of 1 if the county was rural in both 1970 and 2000 and zero otherwise. This variable was interacted with each of the explanatory variables and added to the set of regressors used in the growth regressions using the 1970 sample selection criteria. The coefficient on the dummy variable interaction terms can be interpreted as a measure of the change in the coefficient between the 1970-defined and 2000-defined samples of rural counties. The joint test of significance across all the interacted variables is interpretable as the global test of stability of coefficients between the two sets of counties.

[11] Lant Pritchett (1997) concluded that erroneous findings of economic convergence across countries were driven by similar sorting on prior growth. "Defining the set of countries as those that are the richest *now* almost guarantees the finding of historical convergence, as either countries are rich now and were rich historically, in which case they all have had roughly the same growth rate (like nearly all of Europe) or countries are rich now and were poor historically (like Japan) and hence grew faster and show convergence. However, examples of divergence, like countries that grew much more slowly and went from relative riches to poverty (like Argentina) or countries that were poor and grew so slowly as to become relatively poorer (like India), are not included in the samples of "now developed" countries that tend to find convergence."

[12] We also estimated the regressions using a constant 1970 definition of rural. The estimates were more consistent over time, but there were still significant differences across the equations, with the income growth regressions showing the least persistence.

References

Barro, Robert J. and Xavier Sala-i-Martin, 1995. *Economic Growth.* Cambridge, Massachusetts: The MIT Press.

Baumol, William. 1986. "Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show." *American Economic Review* 79(5):1072-1085.

Carlino, G. and E. Mills. 1987. "The Determinants of County Growth." *Journal of Regional Science* 27:39-54.

Deller, S., T. Tsai, D. Marcouiller, and D. English. 2001. "The Role of Amenities and Quality of Life in Rural Economic Growth." *American Journal of Agricultural Economics* 83(2):352-365.

Fugitt, G., T. Heaton, and D. Lichter. 1988. "Monitoring the Metropolitanization Process." *Demography* 25(1):115-128.

Ghelfi, Linda M. 2002."Rural Earnings up in 2000, but Much Less than Urban Earnings." *Rural America* 17 (4):78-83.

F. K. Hines, D. L. Brown, and J. M. Zimmer. 1975. *Social and Economic Characteristics of the Population in Metro and Nonmetro Counties: 1970*, Economic Research Service.

Isserman, A. 2001. "Competitive Advantages of Rural American in the Next Century." *International Regional Science Review* 24(1):38-58.

Johnson, K. 1989. "Recent Population Redistribution Trends in Nonmetropolitan America." *Rural Sociology* 54(3):301-326.

Maddison, Angus. 1983. "A Comparison of Levels of GDP Per Capita in Developed and Developing Countries, 1700-1980." *Journal of Economic History* 43(1):27-41.

Prichett, Lant. 1997. "Divergence, Big Time." *Journal of Economic Perspectives* 11(3):3-17.

Table 1.1. Description of Rural-Urban Continuum (Beale) Codes

Metro counties:	
0	Central counties of metro areas of 1 million population or more.
1	Fringe counties of metro areas of 1 million population or more.
2	Counties in metro areas of 250,000 to 1 million population.
3	Counties in metro areas of fewer than 250,000 population.
Nonmetro counties:	
4	Urban population of 20,000 or more, adjacent to a metro area.
5	Urban population of 20,000 or more, not adjacent to a metro area.
6	Urban population of 2,500 to 19,999, adjacent to a metro area.
7	Urban population of 2,500 to 19,999, not adjacent to a metro area.
Rural counties:	
8	Completely rural or less than 2,500 urban population, adjacent to a metro area.
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area.

Notes: In 2003, types 0 and 1 are combined.

Table 1.2. Number of Counties by Rural-Urban Continuum Code, 1970 and 2000

	1970 codes									
2000 codes	1	2	3	4	5	6	7	8	9	2000 Total
1	182	91	8	17		63	3	42	4	410
2	1	156	64	13	3	58	2	23	5	325
3		6	114	56	47	40	34	34	20	351
4	1	10	1	85	34	53	30	2	2	218
5				1	64		38		2	105
6		5	4	1	2	317	206	43	28	606
7					3	18	377		48	446
8			1		1	12	9	96	115	234
9						1	33	1	392	427
1970 Total	184	268	192	173	154	562	732	241	616	3,122

1970 code	1	2	3	4	5	6	7	8	9
% unchanged	99%	58%	59%	49%	42%	56%	52%	40%	64%
% moved up	0%	34%	38%	50%	55%	38%	43%	60%	36%
% moved down	1%	8%	3%	1%	4%	6%	6%	0%	0%

Notes: Rows correspond to the 2000 codes; the final column shows the total number of counties in each 2000 category. Columns correspond to the 1970 codes; the bottom row shows the total number of counties in each 1970 category. Gray shaded cells on the diagonal indicate the number of counties in each code that had the same classification at both time periods. Reading across rows shows the distribution of 1970 county types for a particular 2000 code. Reading down columns shows the distribution of 2000 codes for a particular 1970 type. The bottom section of the table calculates the percent of counties that did not change classification; the percent that moved up (became more urban) in the classification scheme; and the percent that moved down (became more rural) in the classification scheme. Cells to the northeast (southwest) of the shaded diagonal display the number of counties moving up (down) in each code.

Table 1.3. Average Population Growth (in Percentage Change) By County Type, 1970-2000

2000 codes	1970 codes: 1	2	3	4	5	6	7	8	9	2000 Total
1	108.2	**111.6**	46.6	**74.4**		**95.5**	54.1	**113.9**	**56.0**	104.1
2	120.9	44.7	**103.2**	**129.0**	**179.6**	**53.1**	**42.1**	**125.5**	**51.4**	68.4
3		32.3	31.5	**62.2**	**58.5**	**63.1**	**69.0**	45.8	**79.8**	51.4
4	545.4	59.8	20.7	18.2	14.5	**86.6**	**64.1**	639.2	**507.3**	55.1
5				-10.1	16.5		**65.4**		**392.0**	41.1
6		29.3	**15.6**	4.6	4.7	22.2	**26.8**	**70.7**	**84.8**	30.0
7					**-21.8**	27.0	13.7		**95.5**	22.8
8			49.4		47.7	11.3	2.0	33.3	**25.4**	27.2
9						24.3	**-13.6**	99.0	4.8	3.6
1970 Total	110.7	67.4	55.7	46.0	31.3	42.5	23.6	69.9	25.4	43.4

Notes: Rows correspond to the 2000 codes; the final column shows the average population growth for counties in each 2000 category. Columns correspond to the 1970 codes; the bottom row shows the average population growth for counties in each 1970 category. Shaded cells indicate average growth for counties that did not change classification over the time period. Bolded numbers indicate a significant difference at the 10% level between average population growth in the off-diagonal cell and average growth in counties with the same 1970 classification and did not change classification by 2000 (the shaded cell average in the same column).

Table 1.4. Average Employment Growth (in Percentage Change) By County Type, 1970-2000

2000 codes	1970 codes 1	2	3	4	5	6	7	8	9	2000 Total
1	236.9	**193.8**	135.7	**108.9**		**119.5**	**93.9**	**160.2**	103.0	192.0
2	332.8	104.6	**175.9**	**186.6**	**206.2**	**80.8**	66.5	**160.0**	68.9	122.3
3		94.9	73.4	**110.0**	**117.1**	**102.8**	**118.1**	72.1	**117.5**	95.3
4	498.6	104.3	53.6	49.5	45.9	**129.5**	**107.5**	475.7	**427.2**	88.9
5				14.5	54.5		**134.8**		**798.0**	97.4
6		67.7	**50.3**	22.5	32.0	52.5	58.2	**106.6**	**125.4**	61.8
7					**-2.9**	**82.0**	51.3		**198.1**	67.5
8			83.8			**32.6**	**24.6**	64.8	**62.3**	60.6
9						84.2	**11.6**	65.8	38.1	36.2
1970 Total	238.8	133.6	109.4	84.7	73.6	74.6	61.0	102.4	65.6	89.2

Notes: Rows correspond to the 2000 codes; the final column shows the average employment growth for counties in each 2000 category. Columns correspond to the 1970 codes; the bottom row shows the average employment growth for counties in each 1970 category. Shaded cells indicate average growth for counties that did not change classification over the time period. Bolded numbers indicate a significant difference at the 10% level between average employment growth in the off-diagonal cell and average growth in counties with the same 1970 classification and did not change classification by 2000 (the shaded cell average in the same column).

Table 1.5. Average Real Income Growth (in Percentage Change) By County Type, 1970-2000

	1970 codes									
2000 codes	1	2	3	4	5	6	7	8	9	2000 Total
1	307.2	**284.8**	190.9	**217.8**		**231.8**	159.4	**300.8**	**195.7**	282.3
2	377.7	148.0	**276.9**	**316.0**	**382.0**	**172.5**	**141.8**	**296.3**	**156.9**	197.7
3		129.8	115.4	**156.6**	**164.8**	**173.8**	**167.4**	156.0	**233.4**	150.9
4	895.4	161.2	106.3	90.6	84.4	**211.5**	**162.3**	**294.3**	**771.3**	144.8
5				31.5	82.3		**165.8**		**944.9**	128.4
6		**97.5**	**90.3**	56.5	73.6	100.1	**114.7**	**167.7**	**199.3**	114.4
7					**28.4**	**122.8**	81.8		**251.3**	100.7
8			101.5			**77.3**	77.8	115.7	**114.9**	112.0
9						118.0	**38.9**	155.0	74.1	71.6
1970 Total	310.8	192.9	171.6	140.8	113.0	138.7	101.0	181.8	112.4	143.7

Notes: Rows correspond to the 2000 codes; the final column shows the average real income growth for counties in each 2000 category. Columns correspond to the 1970 codes; the bottom row shows the average real income growth for counties in each 1970 category. Shaded cells indicate average growth for counties that did not change classification over the time period. Bolded numbers indicate a significant difference at the 10% level between average income growth in the off-diagonal cell and average growth in counties with the same 1970 classification and did not change classification by 2000 (the shaded cell average in the same column).

Table 1.6. Difference in Average Growth of Population, Employment and Real Income, 1970 Rural-Urban Continuum Codes versus 2000 Rural-Urban Continuum Codes

	Code	Population Growth	Employment Growth	Income Growth
Metro	1	-6.6	-46.8	-28.6
		(0.40)	(1.64)	(0.80)
	2	1.0	-11.2	4.8
		(0.13)	(1.05)	(0.33)
	3	-4.3	-14.0	-20.6
		(0.69)	(1.56)	(1.52)
Non-Metro, Partly Urban	4	9.0	-4.2	4.0
		(1.04)	(0.46)	(0.30)
	5	9.7	23.7*	15.4
		(1.25)	(1.80)	(0.98)
	6	-12.5***	-12.8***	-24.3***
		(3.62)	(3.00)	(3.91)
	7	-0.8	6.5	-0.3
		(0.24)	(0.95)	(0.04)
Nonmetro, Completely Rural	8	-42.6***	-41.8***	-69.9***
		(5.14)	(3.95)	(5.33)
	9	-21.8***	-29.4***	-40.8***
		(6.15)	(4.22)	(5.29)

Notes: Columns show the average growth rates using 1970 codes minus average growth rates using 2000 codes; t-statistics in parentheses; *** = significant at the 1% level; ** = significant at the 5% level; *= significant at the 10% level. Negative differences indicate a downward bias from using end-of-period designations; positive differences indicate upward bias.

Table 1.7. Description and Source of Variables Used in Regression Analysis

Variable Label	Definition	Source	Mean	Standard Deviation
$Lpop_{70}$	Natural log of county population	U.S. Census	8.72	0.74
$Lemp_{70}$	Natural log of county employment	Bureau of Economic Analysis	7.76	0.68
$Linc_{70}$	Natural log of county income (in 1970 dollars)	Bureau of Economic Analysis	11.25	1.39
Topography	Topography scale	ERS	1.98	0.90
Jantemp	Mean temperature for January, 1941-1970	ERS	3.30	0.55
Sun	Mean hours of sunlight, January, 1941-1970	ERS	5.03	0.22
Julytemp	Mean temperature for July, 1941-1970	ERS	4.32	0.08
Humid	Mean relative humidity, July, 1941-1970	ERS	3.92	0.36
$HighSchool_{70}$	Proportion of county population whose highest level of education is a high school (diploma or equivalency)	U.S. Census	0.35	0.12
$College_{70}$	Proportion of county population with 4 or more years of college	U.S. Census	0.06	0.03
$Taxperemp_{70}$	Natural log of total tax revenue / employment, all local governments by county ($000)	Census of Governments	5.93	0.65
$Expperemp_{70}$	Natural log of total general direct expenditures / employment, all local governments by county ($000)	Census of Governments	6.85	0.40

Table 1.7. (continued)

Variable Label	Definition	Source	Mean	Standard Deviation
Area	Natural log of county area in square miles (in hundreds)	U.S. Census	1.95	0.77
$Adjacent_{70}$	Dummy variable =1 if the county is adjacent to a metropolitan area (Beale code 8)	ERS	0.28	0.45
West	Dummy variable =1 if the county is in the Mountain or Pacific Census divisions	ERS	0.16	0.37
South	Dummy variable =1 if the county is in the South Atlantic, East South Central or West South Central Census divisions	ERS	0.44	0.50
Northeast	Dummy variable =1 if the county is in the New England or Middle Atlantic Census divisions	ERS	0.02	0.14
Central	Dummy variable =1 if the county is in the East North Central or West North Central Census divisions	ERS	0.37	0.48
% $Non\text{-}white_{70}$	Proportion of county residents non-white	U.S. Census	0.09	0.17
% $65+_{70}$	Proportion of county residents age 65 or older	U.S. Census	0.13	0.04

Table 1.8. Comparison of Regression Results Using Beginning- and End-of-Period Designations to Determine Rural Status

	Population Growth, 1970-2000			Employment Growth, 1970-2000			Income Growth, 1970-2000		
	Beginning (1)	End (2)	Difference (3)	Beginning (4)	End (5)	Difference (6)	Beginning (7)	End (8)	Difference (9)
Intercept	10.40***	1.54*	0.76	10.72***	0.41	0.51	-2.47	-1.20	0.33
	(6.80)	(1.84)		(6.13)	(0.43)		(1.31)	(1.08)	
Lpop$_{70}$	0.12***	0.02***	2.48†	0.00‡	0.00‡		0.02	0.02*	1.96†
	(5.56)	(3.47)					(0.82)	(1.75)	
Lemp$_{70}$	0.00‡	0.00‡		0.08***	0.01	0.75	0.00‡	0.00‡	
				(3.50)	(1.51)				
Linc$_{70}$	-0.03***	-0.01*	2.72†	-0.05***	-0.02***	2.40†	0.06***	0.05***	2.25†
	(3.50)	(1.73)		(4.47)	(2.88)		(4.81)	(7.24)	
Topography	-0.02	0.01	0.63	0.02	0.03***	0.18	0.01	0.03**	0.90
	(0.88)	(1.05)		(0.99)	(3.51)		(0.54)	(2.25)	
Jantemp	0.41***	0.26***	1.95	0.31***	0.15***	0.24	-0.07	-0.04	0.23
	(9.68)	(10.50)		(6.41)	(5.53)		(1.34)	(1.25)	
Sun	0.15**	0.16***	3.06†	0.15*	0.12***	2.32†	-0.18**	-0.15***	0.98
	(2.26)	(4.84)		(1.95)	(3.14)		(2.13)	(3.33)	
Julytemp	-2.99***	-1.06***	1.35	-3.16***	-0.91***	0.12	0.71*	0.51**	0.27
	(8.74)	(5.58)		(8.10)	(4.24)		(1.68)	(2.03)	
Humid	-0.26***	0.01	0.40	-0.17**	0.13***	0.12	0.06	0.00	0.49
	(3.58)	(0.31)		(2.01)	(2.85)		(0.63)	(0.02)	
HighSchool$_{70}$	-0.36*	0.07	2.42†	-0.74***	0.01	1.13	0.26	0.15	2.80†
	(1.86)	(0.61)		(3.26)	(0.08)		(1.06)	(1.02)	
College$_{70}$	1.09*	0.88***	0.58	1.36**	2.36***	2.39†	0.47	-0.45	0.34
	(1.91)	(4.02)		(2.07)	(9.36)		(0.67)	(1.55)	
Taxperemp$_{t-10}$	-0.04	-0.05**	1.75	-0.06	-0.05**	2.27†	0.05	0.07**	2.00†
	(1.13)	(2.54)		(1.42)	(2.11)		(1.07)	(2.45)	
Expperemp$_{t-10}$	0.19***	0.24***	0.71	0.38***	0.39***	0.79	-0.01	-0.08***	1.20
	(4.63)	(10.27)		(8.27)	(14.45)		(0.25)	(2.61)	
Area	-0.04*	-0.02	0.98	-0.04	-0.02	0.11	0.04	0.04**	0.89
	(1.85)	(1.52)		(1.57)	(1.49)		(1.35)	(2.51)	

Table 1.8. (continued)

Adjacent	0.18***	-0.03	1.63	0.15***	-0.07**	1.02	0.03	0.07**	0.18
	(6.33)	(1.08)		(4.51)	(2.36)		(0.90)	(2.18)	
West	0.06	0.24***	0.78	0.00	0.20***	0.40	0.02	0.07	0.36
	(0.82)	(5.76)		(0.00)	(4.33)		(0.28)	(1.22)	
South	0.12**	0.24***	2.05†	0.15***	0.28***	1.71	-0.10*	-0.08**	1.67
	(2.39)	(9.24)		(2.63)	(9.56)		(1.65)	(2.40)	
Northeast	0.29***	-0.05*	0.38	0.30***	-0.13***	0.25	-0.08	-0.16***	0.84
	(3.16)	(1.72)		(2.82)	(3.87)		(0.67)	(4.17)	
% Non-white	-0.13	-0.42***	1.90	-0.43***	-0.68***	0.02	0.14	0.16**	0.38
	(1.39)	(7.29)		(3.89)	(10.34)		(1.15)	(2.10)	
% 65 +	0.08	-0.69***	0.03	-0.05	-1.03***	0.28	-0.99**	-0.15	0.43
	(0.20)	(3.52)		(0.12)	(4.68)		(2.10)	(0.58)	
R-square	0.3968	0.2401		0.3154	0.2078		0.0865	0.057	
N	846	654		846	654		846	654	
Joint F			14.05†			10.54†			2.03†

Notes: t-statistics in parentheses; *** = significant at the 1-% level; ** = significant at the 5-% level; *= significant at the 10-% level. The dependent variables are measured as growth rates; in columns (1) to (3), the dependent variable is population growth, in columns (4)-(6), the dependent variable is employment growth, and in columns (7)-(9), the dependent variable is real income growth. In columns (1), (4), and (7), the set of rural counties is defined by 1970 Beale code designations; in columns (2), (5), and (8), the set of rural counties is defined by 2000 Beale code designations. Columns (3), (6) and (9), report the t-statistic from the test that the coefficient is different across equations. The Joint-F reports the F statistic from the test that all coefficients are jointly different across equations. † indicates significance at the 5-% level. See text for further explanation. ‡ Coefficient restricted to 0 due to high correlation between lpop and lemp.

Table 1.9. Correlation of Rural Counties' Growth Rates Between Decades

	Population Growth		Employment growth		Real Income Growth	
Decades	Beginning (1)	End (2)	Beginning (3)	End (4)	Beginning (5)	End (6)
70s & 80s	0.68	0.58	0.31	0.24	0.12	0.15
80s & 90s	0.70	0.61	0.40	0.32	0.36	0.37
70s & 90s	0.66	0.60	0.29	0.24	0.52	0.53

Notes: This table shows the correlation of county-level growth rates between decades for rural counties (Beale codes 8 and 9). In columns (1), (3) and (5) the set of rural counties is selected based on 1970 rural designations. In columns (2), (4), and (6), the set of rural counties is selected based on 2000 rural designations.

Table 1.10. Comparison of Regression Results Across Decades

	Population Growth			
	1970s	1980s	1990s	
Variable	(1)	(2)	(3)	(4)
Intercept	3.87***	1.060*	2.57***	5.41†
	(5.56)	(1.95)	(4.69)	
$Lpop_{t-10}$	0.06***	0.05***	0.06***	0.05
	(6.15)	(7.73)	(7.86)	
$Lemp_{t-10}$	0.00‡	0.00‡	0.00‡	
$Linc_{t-10}$	-0.01***	-0.01**	-0.01***	0.23
	(2.58)	(2.48)	(3.57)	
Topography	0.01	-0.011*	0.00	1.37
	(0.65)	(1.78)	(0.32)	
Jantemp	0.15***	0.09***	0.09***	4.37†
	(7.85)	(6.66)	(6.61)	
Sun	0.01	0.08***	0.07***	2.05
	(0.43)	(3.43)	(3.01)	
Julytemp	-1.12***	-0.44***	-0.83***	6.31†
	(7.20)	(3.70)	(6.71)	
Humid	-0.12***	-0.06**	0.00	4.03†
	(3.48)	(2.53)	(0.13)	
$HighSchool_{t-10}$	-0.08	-0.02	0.07	0.88
	(0.95)	(0.22)	(0.90)	
$College_{t-10}$	0.68***	0.35**	0.16	1.96
	(2.62)	(2.47)	(1.17)	
$Taxperemp_{t-10}$	-0.01	-0.01	0.02	1.05
	(0.41)	(0.58)	(1.46)	
$Expperemp_{t-10}$	0.09***	0.02	0.00	8.80†
	(4.66)	(1.24)	(0.03)	
Area	-0.01	0.00	-0.03***	1.64
	(1.08)	(0.55)	(3.35)	
Adjacent	0.05***	0.05***	0.04***	0.36
	(3.74)	(4.84)	(3.77)	
West	0.01	-0.01	0.08***	2.82
	(0.24)	(0.30)	(3.28)	
South	0.08***	0.02	0.04**	2.47
	(3.38)	(1.15)	(2.20)	
Northeast	0.079*	0.09***	-0.07**	5.31†
	(1.87)	(2.71)	(2.06)	
% Non-white	-0.13***	-0.08**	0.00	3.01†
	(2.92)	(2.54)	(0.15)	
% 65 +	0.04	-0.70***	-0.55***	7.41†
	(0.21)	(5.75)	(4.87)	
R-square	0.3498	0.3622	0.4283	
N	846	771	767	
Joint-F				13.92†

Table 1.10. (continued)

	Employment Growth			
	1970s	1980s	1990s	
Variable	(5)	(6)	(7)	(8)
Intercept	2.13**	3.89***	3.15***	1.00
	(2.20)	(4.84)	(3.57)	
$Lpop_{t-10}$	0.00‡	0.00‡	0.00‡	
$Lemp_{t-10}$	0.05***	0.03***	0.01	2.37
	(3.54)	(3.13)	(0.98)	
$Linc_{t-10}$	-0.02***	-0.02***	-0.01**	0.91
	(2.67)	(4.24)	(2.01)	
Topography	0.03**	-0.01	0.00	3.33†
	(2.43)	(0.57)	(0.36)	
Jantemp	0.09***	0.12***	0.05**	2.37
	(3.36)	(6.10)	(2.31)	
Sun	0.05	0.04	0.07*	0.18
	(1.12)	(1.03)	(1.77)	
Julytemp	-0.85***	-1.05***	-0.90***	0.28
	(3.94)	(5.90)	(4.51)	
Humid	-0.05	-0.04	0.06	2.23
	(1.13)	(1.13)	(1.51)	
$HighSchool_{t-10}$	-0.215*	-0.24**	-0.14	0.18
	(1.72)	(2.29)	(1.03)	
$College_{t-10}$	1.32***	0.30	0.49**	3.37†
	(3.60)	(1.42)	(2.28)	
$Taxperemp_{t-10}$	-0.04	-0.025*	0.02	2.81
	(1.60)	(1.79)	(1.24)	
$Expperemp_{t-10}$	0.22***	0.07***	0.02	20.85†
	(8.45)	(3.77)	(0.82)	
Area	-0.025*	0.02	-0.04***	4.14†
	(1.65)	(1.35)	(2.79)	
Adjacent	0.04**	0.04***	0.06***	0.31
	(2.11)	(2.75)	(3.51)	
West	0.01	-0.08**	0.07*	3.58†
	(0.27)	(2.36)	(1.75)	
South	0.08**	0.046*	0.00	1.82
	(2.32)	(1.80)	(0.01)	
Northeast	0.05	0.13***	-0.07	2.97
	(0.77)	(2.70)	(1.18)	
% Non-white	-0.30***	-0.27***	-0.01	9.20†
	(4.95)	(5.62)	(0.17)	
% 65 +	-0.60**	-0.49***	-0.43**	0.19
	(2.47)	(2.66)	(2.36)	
R-square	0.2497	0.257	0.1795	
N	846	771	767	
Joint-F				8.73†

Table 1.10. (continued)

	Income Growth			
	1970s	1980s	1990s	
Variable	(9)	(10)	(11)	(12)
Intercept	-0.22	-1.34	-0.65	0.40
	(0.22)	(1.57)	(0.85)	
$Lpop_{t-10}$	0.01	0.00	0.00	0.29
	(0.72)	(0.34)	(0.27)	
$Lemp_{t-10}$	0.00‡	0.00‡	0.00‡	
$Linc_{t-10}$	0.01	0.03***	0.03***	4.37†
	(1.36)	(5.39)	(6.34)	
Topography	0.00	0.00	0.00	0.03
	(0.17)	(0.13)	(0.07)	
Jantemp	0.00	-0.03	-0.02	0.44
	(0.09)	(1.30)	(0.80)	
Sun	-0.13***	-0.02	-0.06	1.88
	(2.83)	(0.60)	(1.61)	
Julytemp	0.27	0.18	0.21	0.05
	(1.20)	(0.98)	(1.24)	
Humid	-0.02	0.10**	0.02	2.25
	(0.47)	(2.55)	(0.51)	
$HighSchool_{t-10}$	0.07	0.26**	-0.09	1.83
	(0.57)	(2.28)	(0.82)	
$College_{t-10}$	0.18	0.07	0.04	0.06
	(0.47)	(0.31)	(0.22)	
$Taxperemp_{t-10}$	0.03	0.02	0.04***	0.50
	(1.11)	(1.35)	(2.97)	
$Expperemp_{t-10}$	-0.04	-0.01	-0.03*	0.67
	(1.63)	(0.34)	(1.65)	
Area	0.028*	0.01	-0.01	2.10
	(1.82)	(0.99)	(0.95)	
Adjacent	0.02	-0.01	0.00	1.11
	(1.29)	(0.54)	(0.03)	
West	0.00	0.04	0.03	0.25
	(0.02)	(0.99)	(0.81)	
South	-0.08**	0.02	-0.07***	3.40†
	(2.20)	(0.67)	(3.17)	
Northeast	-0.04	-0.02	-0.02	0.06
	(0.70)	(0.34)	(0.47)	
% Non-white	0.05	0.05	0.05	0.00
	(0.72)	(0.91)	(1.09)	
% 65 +	-0.38	-0.07	-0.24	0.55
	(1.50)	(0.36)	(1.52)	
R-square	0.0671	0.0726	0.0958	
N	846	771	767	
Joint-F				2.15†

Notes: t-statistics in parentheses; *** = significant at the 1-% level; ** = significant at the 5-% level; *= significant at the 10-% level. The dependent variables are measured as growth rates by decade; in columns (1) to (4), the dependent variable is population growth, in columns (5)-(8), the dependent variable is employment growth, and in columns (9)-(12), the dependent variable is real income growth. The set of rural counties is defined by beginning of decade Beale code designations. Columns (4), (8) and (12), report the F statistic from a test of the difference of coefficients across equations. The last row reports the Joint F-statistic of the null hypothesis that all coefficients are equal across time periods. † indicates significance at the 5-% level. See text for further explanation. ‡ Coefficient restricted to 0 due to high correlation between lpop and lemp.

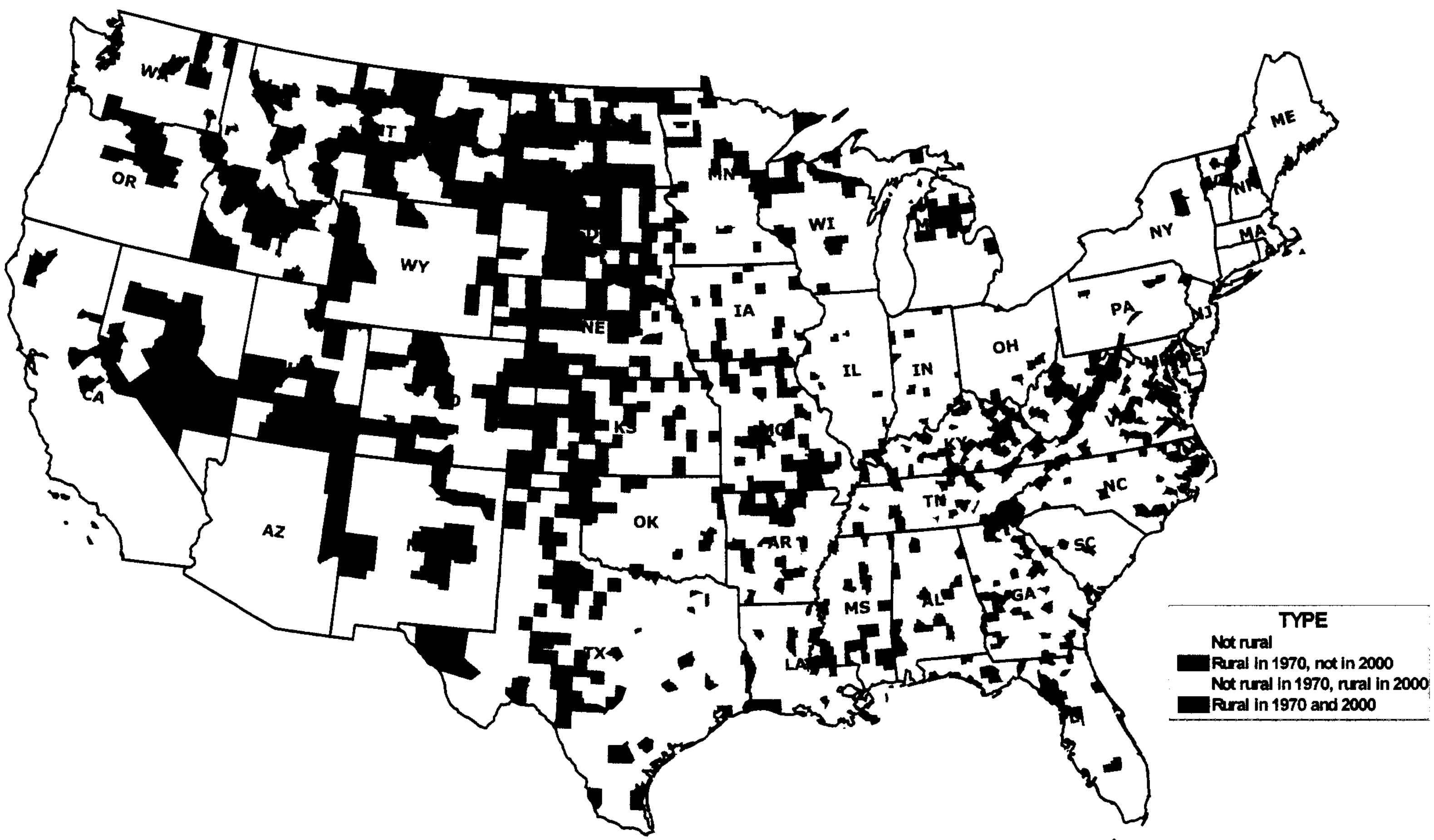

Figure 1.1. Location of Rural Counties, 1970 and 2000

Appendix 1A

Table A1. Articles Addressing Metro/Nonmetro or Rural/Urban Differences Over Time: Published In *Rural Sociology*, *Growth and Change*, *AJAE*, *Regional Studies* & *Journal of Regional Science*, 2002-present

Article	Data	Time Frame	Urban/Rural Classification Period	Potential Bias[a]
Albrecht & Albrecht, "Metro/Nonmetro Residence, Nonmarital conception and Conception Outcomes, " *Rural Sociology* 69:3 (2004):430-452.	1995 Cycle of the National Survey of Family Growth	1965 - 1995	1990 classifications	E
Allen, B.L., "Race and Gender Inequality in Homeownership: Does Place Make a Difference?" *Rural Sociology* 67:4 (2002): 603-621.	IPUMS	1970, 1980, 1990	Unclear	U
Goe, W. Richard, "Factors Associated with the Development of Nonmetropolitan Growth Nodes in Producer Services Industries, 1980-1990," *Rural Sociology* 678:3 (2002):416-441.	Economic Census, CBP	1980-1990	1990 classifications	E
Goetz S.J. & Rupasingha A. "The New Rural Economy: High–Tech Firm Clustering: Implications for Rural Areas", AJAE84:5 (December 2002):1229-1236.	CBP	1990-1999	Unclear	U
Hammond, George W. and Eric Thompson, "Employment Risk in U.S. Metropolitan and Nonmetropolitan Regions: the Influence of Industrial Specialization and Population Characteristics," *J. of Regional Science*, 44:3 (2004):517-542.	BEA	1969-1999	Commuting regions based on 1990 classifications: Metropolitan regions include at least one (MSA) or (PMSA). Nonmetropolitan regions do not include an MSA. 256 metro regions and 466 nonmetro regions in the lower 48 U.S. states.	E
Huang TL, Orazem P. & Wohlgemuth D., "Rural Population Growth, 1950–1990: The Roles of Human Capital, Industry Structure, and Government Policy," *AJAE* 84:3 (Aug 2002): 615-627.	Census, other various	1950-1990	Applied 1980 definitions and criteria to approximate 1950 classifications	B
Hunter, L. & J. Sutton, "Examining the Assoc. B/w Hazardous Waste Facilities and Rural 'Brain Drain'", *Rural Sociology* 69:2 (2004):197-212	US Census , 85-90 migration data	1985-1990	Unclear, 2358 NM counties implies the use of 1980 classifications	B
Leichenko & Silva, "International Trade, Employment and Earnings: Evidence from US Rural Counties," *Regional Studies*, 38(4) (June 2004):355–374.	Census (LRD), other various	1972-1995	Unclear	U

Table A1. (continued)

Article	Data	Time Frame	Urban/Rural Classification Period	Potential Bias[a]
Martin, Richard W., "Spatial Mismatch and the Structure of American Metropolitan Areas, 1970-2000, *J. of Regional Science*, Vol. 44:3 (2004):467-488	Census, CBP	1970-2000	2000 MSA designations (729 counties belonging to 179 MSAs)	E
McLaughlin, D., "Changing Income Inequality in Nonmetropolitan Counties, 1980 to 1990," *Rural Sociology* 67:4 (2002):512-533.	Census	1980-1990	Unclear, 2257 NM counties implies the use of 1990 classifications	E,
Mills, B and Hazarika, "Do Single Mothers Face Greater Constraints to Work Force Participation in Nonmetropolitan Areas?" *AJAE*, 85:1 (February 2003):143-161.	CPS	1993-1999	Unclear	U
Pagoulatus, S., S. Goetz, D. Debertin, & T. Johannson, "Interactions Between Economic Growth and Environmental Quality in US Counties, 1987-1995," *Growth and Change*, 35:1 (February 2004):90-108.	USA Counties	1987-1995	Unclear, 23% of counties designated as metro which implies the use of 1980 classifications	B
Renkow, M. "Employment Growth, Worker Mobility, and Rural Economic Development," *AJAE*, 85:2 (May 2003): 503-513.	Census, BEA	'80-'90	1980 classifications	B
Sharp, J., B. Roe and E. Irwin, "The Changing Scale of Livestock Production in and around Corn Belt Metropolitan Areas, 1978–97", *Growth and Change* 33:1 (Winter 2002): 115-132.	Ag Census, Census	1978-1997	1990 classifications	E
Slack, T. & L. Jensen, "Race, Ethnicity and Underemployment in Nonmetropolitan America: A 30-Year Profile," *Rural Sociology* 67:2 (2002): 208-237.	CPS	1968-1998	Unclear	U
Snyder, A., S. Brown & E. Condo, "Residential Differences in Family Formation: The Significance of Cohabitation," *Rural Sociology* 69:2 (2004): 235-260.	1995 Cycle of the National Survey of Family Growth	1965 - 1995	1990 classifications	E
Snyder A. and D. McLaughlin, "Female-Headed Families and Poverty in Rural America," *Rural Sociology* 69:1 (2004):127-149.	CPS	1980, 1990, 2000	Unclear	U

Table A1. (continued)

Article	Data	Time Frame	Urban/Rural Classification Period	Potential Bias[a]
Stretesky, P, J. Johnson and J. Arney, "Environmental Inequity: An Analysis of Large-Scale Hog Operations in 17 States, 1982-1997," *Rural Sociology* 68:2 (2003):231-252.	Ag Census	1982, 1987, 1992, 1997	1990 classifications	E
Thomas, J. and F. Howell, "Metropolitan Proximity and US Agricultural Productivity 1978-1997," *Rural Sociology* 68:3 (2003):366-386.	Ag Census	1978, 1982, 1987, 1992, 1997	Use 1980 classifications for changes over the 1978-87 period and 1990 classifications for changes over the 1992-97 period	C

[a]Possible bias due to sample selection where B indicates classification of rural/urban or nonmetropolitan/metropolitan at the beginning of the analysis, E designates classification in the middle or at the end of the analysis, C means the authors allow the status to change over time and U indicates that the timing of classification is unknown.

Measuring the Impact of Meat Packing and Processing Facilities in the Nonmetropolitan Midwest: A Difference-in-Differences Approach[1]

A paper to be submitted to the *American Journal of Agricultural Economics*

Georgeanne Artz[a], Peter Orazem and Daniel Otto

Abstract

Considerable controversy exists regarding the costs and benefits of growth in the meat packing and processing industry in the rural Midwest. This study uses proprietary data from the Bureau of Labor Statistics' Longitudinal Database (LDB) to investigate the effects of this industry on social and economic outcomes in non-metropolitan counties of twelve Midwestern states from 1990-2000. A difference-in-differences specification is used to measure how local growth in meatpacking and processing affects growth in local economies, government expenditures, and crime rates. Propensity score matching is used as a check on possible non-random placement of meatpacking and processing plants. Results suggest that as the meat packing industry's share of a county's total employment and wage bill rises, total employment growth increases. However, employment growth in other sectors slows, as does local wage growth. There is some evidence that slower wage growth swamps the employment growth so that aggregate income grows more slowly. We find no evidence that growth in the industry changes the growth rates for crime or government spending.

[a] Primary researcher and author.

Introduction

Meat packing and processing facilities have a prominent, yet controversial presence in the Midwestern United States. On the one hand, attracting agricultural processing facilities is an increasingly popular strategy for rural communities since it is viewed as a good fit for agriculturally dependent regions. The industry is an important provider of entry-level opportunities for low-skilled labor and new immigrants to the country and the region (Huffman and Miranowski 1996). New facilities may provide expanded job opportunities, supplemental income for farm families, increased public revenues, and stimulus for further development in other sectors such as retail trade and services (Leistritz and Sell, 2001; Drabenstott, Henry and Mitchell 1999). On the other hand, the expansion of large-scale meat processing facilities generates concerns about the potential negative impacts on the host communities. Opponents fear environmental damage to air and water quality, the inconvenience of bilingual commerce, higher levels of crime, increased welfare loads, and heavier burdens on public services such as schools and low-income housing.

The controversy surrounding the siting of a new plant is illustrated by the 1999 attempt by Excel Corporation and the Iowa Cattlemen's Association to locate a beef packing plant in Iowa. The proposed plant was expected to be a state-of-the-art facility, employing 1,000 workers and processing 500,000 head of cattle per year. As potential locations for the plant were named, local residents were quick to voice their opposition to the plant. In Pleasant Hill, Iowa, residents organized anti-packing plant meetings even before the company announced proposed locations (Eckhoff 2000). In Cambridge, Iowa, one proposed location for the plant, citizens posted roadside signs opposing the plant and turned out in force to voice their concerns about the plant in a town meeting later described in the *Des Moines Register* as "ugly" (August 6, 2000). Shortly thereafter, the county supervisors refused to support the proposal. Supervisors in Hardin County, another named prospective location, voted unanimously to oppose hosting the plant, citing concerns about the existing infrastructure's ability to support the large facility. Given this opposition to the plant, Excel Corporation and the Iowa Cattlemen's Association put the project on hold. It was later abandoned in 2003 when the Cattlemen's Association decided instead to renovate a closed plant in Tama, Iowa.

The debate over the impact (good or bad) of livestock packing and processing plants on their host communities is largely informed by journalistic accounts, such as in the 2001 bestseller *Fast Food Nation.* Author Eric Schlosser paints a grim picture of the effects of a new meatpacking plant on Lexington, Nebraska:

> In 1990, IBP opened a slaughterhouse in Lexington. A year later, the town, with a population of roughly seven thousand, had the highest crime rate in the state of Nebraska. Within a decade, the number of serious crimes doubled; the number of Medicaid cases nearly doubled; Lexington became a major distribution center for illegal drugs; gang members appeared in town and committed drive-by shootings; the majority of Lexington's white inhabitants moved elsewhere; and the proportion of Latino inhabitants increased more than tenfold, climbing to over 50 percent. (p. 165)

The academic research on this topic consists primarily of case study analyses. These studies document a variety of social and economic consequences following the opening of large meat packing plants that may be described as a mixed blessing for host towns. The opening of a new establishment may increase local demand for animals and feed in the region (Broadway 2000). It also provides new jobs to the community. The evidence from these studies suggests that host communities experience growth in employment and payroll, not only in manufacturing, but also in retail and services, yet the job growth tends to be concentrated in low-paying jobs. In Garden City, Kansas, the per capita income level and average wage in the area rose in the decade following the opening of a large packing plant, but not as much as in the rest of the state (Broadway, Stull, and Podraza 1994). A number of social problems have been documented in meat packing towns, including increased crime rates and child abuse cases, higher housing and rental prices due to shortages, and additional strain on social services and the health care system. (Broadway 1990; Broadway, Stull, and Podraza 1994; Grey 1997b). Schools in host communities feel the impacts of the plant through greater numbers of limited-English proficient students and unstable school enrollments that reflect high turnover rates at the plant (Grey 1997a). In addition, there are environmental concerns regarding odor and ground and water pollution (Hackenberg, 1995).

These studies examine changes in a particular community or set of communities before and after the opening of plants, but generally do not provide a frame of reference by comparing the meat packing towns with similar communities that do not have meat packing or processing facilities. They all focus on very large plants despite the fact that, except for poultry processing, the majority of meat packing and processing firms have fewer than 100 employees (County Business Patterns, 2001).[2] It is true, however, that industry concentration has increased dramatically over the past few decades (Ollinger, MacDonald and Madison 2005; MacDonald and Ollinger 2005). Rising firm size increases the chance a community will experience adverse external effects from expansion.

Recent research on whether large plant sitings generate positive and significant net economic benefits for their host communities is mixed. In a study of new firm locations employing at least 1,000 workers over the period 1980 to 1989, Fox and Murphy (2004) find little evidence to suggest that the presence of these large firms affects future employment or income growth in the local region. Edmiston (2004) examines large plant locations and expansions in Georgia counties from 1984-1998. His results show that while firm expansions yield approximately two hundred workers on net for every one hundred new firm employees, new locations yield a net gain of only 29 workers in the county for every one hundred new firm employees. In contrast, a study by Greenstone and Moretti (2003) of "million dollar plants" finds that the opening of a large plant significantly increases the trend in the host county's total wage bill. Five years after the plant's opening, they estimate that the average county wage bill for host counties is nine percent higher due to the new plant. In addition, they find no evidence that the plant reduces property values or affects local government spending.

Our focus on meatpacking plants is particularly useful in light of these more general studies of plant siting effects. Because the acrimony surrounding the siting of meatpacking plants arguably exceeds that in other sectors, this sector could be viewed as a worst case scenario for new plant sitings. Secondly, meatpacking represents one of the few sectors expanding manufacturing jobs in rural areas that have otherwise faced slow economic expansion. Finally, because meatpacking plants are more homogeneous than the variety of manufacturers analyzed in these previous studies, we have many similar cases to evaluate, and our results are less likely to be driven by the unique circumstances surrounding the siting of one-of-a-kind plants. Our concentration on Midwestern non-metropolitan counties assures that the counties are of similar size and face similar economic opportunities and challenges.

This research employs longitudinal cross-sectional data on meat packing and processing facilities from the Bureau of Labor Statistics' Longitudinal Database (LDB) from 1990 to 2000.[3] We compare changes in social and economic indicators in non-metropolitan counties with and without meat packing and processing jobs. The social and economic outcomes include changes in county employment, wages and income, as well as changes in county crime rates and local government expenditures for education, police protection and health. The industries we consider are Animal (except poultry) Slaughtering (NAICS 311611), Meat Processed from Carcasses (NAICS 311612), Rendering and Meat Byproduct Processing (NAICS 311613), Poultry Processing (NAICS 311615) and Frozen Specialty Food Manufacturing (NAICS 311412). Using the LDB, counties in twelve Midwestern states are classified into one of five categories based on whether a facility in any of these industries (a) was present continuously, (b) entered, (c) closed, (d) both entered and exited, or (e) was not present, during the period 1990-2000. Establishment-level employment and wage data are aggregated to the county level and used to construct relative measures of earnings and employment in order to analyze the importance of overall size of the industry in the county. In addition, we investigate the possibility that higher-value processing facilities generate social and economic impacts that are different from those of packing facilities.

We find that as the meat packing and processing industry's share of a county's total employment and wage bill rises, total employment growth increases, while wage growth slows relative to counties without the industry. Income growth, the product of employment and wage growth, is relatively slower as well, indicating that the negative wage effect swamps the positive employment effect. Employment net of the meatpacking sector grows more slowly, suggesting that meatpacking employment grows at the expense of employment growth in other sectors of the economy. However, contrary to the findings of previous research on this topic, there is no significant difference in the growth of violent or property crime in counties with and without meatpacking, and the point estimates, although imprecise, suggest slower crime growth in counties with these plants. In addition, there is little evidence that growth in the industry affects local government expenditures in total, or on education, police protection, or health. Our results are robust to differences in assumptions regarding the exogeneity or endogeneity of the presence of a packing or a processing plant. Our findings are also basically unchanged when we examine meat packing separately from meat processing or poultry processing.

Conceptual Framework

Previous research suggests that the presence of the meat packing industry may have positive or negative effects on a county's economic growth. On the one hand, the industry adds jobs and income to the local economy, and potentially spawns additional business growth up and down the supply chain. On the other hand, the presence of the industry may deter additional growth if it generates negative social impacts such as increased crime or pollution or if it imposes costs on the local government (education, transportation, sewage or other infrastructure investments) that dissuade other businesses from entering.

We follow the model of local growth presented in Glaeser, Scheinkman, and Shleifer (1995). Let total output in county i at time t be a function of county technology, $A_{i,t}$ and employment, $L_{i,t}$:

$$A_{i,t} f(L_{i,t}) = A_{i,t} L_{i,t}^{\alpha} \tag{1}$$

This production function, assumed to be Cobb-Douglas with $\alpha<1$, is common across counties. A potential migrant's labor income is the marginal product of labor and his utility in county i at time t is the product of wages and a quality of life good, $Z_{i,t}$:

$$U(\cdot) = \alpha A_{i,t} L_{i,t}^{\alpha-1} Z_{it} \tag{2}$$

Individuals are assumed to freely migrate across counties; in equilibrium utility will be constant across space at any point in time. Given these assumptions, each individual's utility level in each county must equal the reservation utility at time t, denoted Ur. Therefore, for each county:

$$\ln Ur_{i,t+1} - \ln Ur_{i,t} = (\ln A_{i,t+1} - \ln A_{i,t}) + (\ln Z_{i,t+1} - \ln Z_{i,t}) + (1-\alpha)(\ln L_{i,t+1} - \ln L_{i,t}) \tag{3}$$

Assume further that growth in quality of life and county productivity are determined by $X_{i,t}$, a vector of county level characteristics:

$$\ln A_{i,t+1} - \ln A_{i,t} = X'_{i,t}\gamma + \psi_{i,t+1} \tag{4a}$$

$$\ln Z_{i,t+1} - \ln Z_{i,t} = X'_{i,t}\theta + \xi_{i,t+1} \tag{4b}$$

Substituting these equations into (4) and rearranging, we obtain:

$$\ln L_{i,t+1} - \ln L_{i,t} = \frac{1}{(1-\alpha)}\left(X'_{i,t}(\gamma+\theta)\right) + \chi_{i,t+1} \tag{5a}$$

$$\ln w_{t+1}(\cdot) - \ln w_t = X'_{i,t}(2\gamma+\theta) + \upsilon_{i,t+1} \tag{5b}$$

where $\chi_{i,t+1}$ and $\upsilon_{i,t+1}$ are error terms that are uncorrelated with county characteristics. Let the set of outcomes that we are interested in measuring, including employment growth, wage growth, and changes in quality of life goods, be denoted by Q. Then, more generally, growth in each outcome is a function of the same county level attributes:

$$\ln Q_{i,t+1} - \ln Q_{i,t} = X'_{i,t}\beta + \varepsilon_{i,t+1} \tag{6}$$

Empirical Specification

Equation (6) provides the basis for our empirical specification, a difference-in-differences model. The difference-in-differences estimation method is commonly used to measure the effects of a treatment, such as a training program, on the behavior of those who have received the treatment. A comparison of outcomes is made both before and after treatment and with a control group of similar people not receiving the treatment. In this study, the treatment group is composed of counties that have meat packing or processing jobs at some time during the study period. The control group is composed of otherwise similar counties that do not have jobs in the industry during the study period.

In addition to measuring growth in employment and wages, we also analyze income growth. Our measures of changes in quality of life, Z, include growth in local government expenditures in total and on health, education, and police protection and changes in crime rates. County attributes, $X_{i,t}$, include environmental amenities and other local attributes, as well as the presence and relative size of the livestock processing industry.

Let the share of the livestock processing industry in county i and year t be represented by the variable M_{it}, a continuous measure between 0 and 1. M_{it} will vary across types of counties and also within the treatment group of counties having the meat packing/processing industry (MPP). The impact of changes in M_{it} from period 0 to period 1 can be captured by modifying equation (6) as in:

$$\ln Q_{it+1} - \ln Q_{it} = \delta(\ln M_{it+1} - \ln M_{it}) + \beta(\ln X_{it+1} - \ln X_{it}) + (\varepsilon_{it+1} - \varepsilon_{it}) \quad (7)$$

where M_{it} measures livestock processing in county i at time t and X_{it}, is a vector of variables measuring other attributes in county i at time t. The effect of growth in the relative size of the MPP industry in the county on the growth rate of Q is measured by δ.

There may be differential impacts for counties that lost or gained MPP plants relative to counties that always or never had plants. Let C_i, G_i, L_i and B_i be dummy variables equal to one if the county had the industry continuously during the period, gained the industry during the period, lost the industry during the period, or both gained and lost the industry, respectively. Equation (7) can be modified as follows:

$$\begin{aligned} \ln Q_{it+1} - \ln Q_{it} &= \delta_G G_{it}(\ln M_{it+1} - \ln M_{it}) + \delta_L L_{it}(\ln M_{it+1} - \ln M_{it}) \\ &+ \delta_C C_{it}(\ln M_{it+1} - \ln M_{it}) + \delta_B B_{it}(\ln M_{it+1} - \ln M_{it}) + \beta(\ln X_{it+1} - \ln X_{it}) \quad (8) \\ &+ (\varepsilon_{it+1} - \varepsilon_{it}) \end{aligned}$$

This specification allows growth in the MPP industry to have different effects according to the status of the industry during the study period. In each case the reference group is the counties that never had livestock packing or processing facilities, and δ_G, δ_L, δ_C and δ_B measure the relative effect on Q growth of gaining, losing, continuously having, or both gaining and losing MPP jobs.

Table 2.1 describes the variables used in the estimation. Measures of economic change include growth in county income, employment and average wage rates. These data were obtained from the Bureau of Economic Analysis. In addition, we examine the growth in net employment, measured as total county employment growth minus employment growth in the meat packing and processing industry. While growth in the industry is expected to spur total employment growth, it is unclear whether the industry will induce positive employment growth in other sectors due to agglomeration effects or if MPP industry growth will deter employment growth in other sectors due to negative spillovers, such as increased factor costs or congestion.

One of the biggest concerns of communities gaining meat packing facilities is the potential impact on crime rates. We have included two measures of crime, the change in property crime rates and the change in violent crime rates, obtained from FBI Uniform Crime reports. The measures of fiscal changes included in the analysis are total direct general expenditures by local governments as well as direct general expenditures on police protection, education, and health and hospitals. A separate regression is estimated for each of these outcome variables.

Two measures of the MPP industry are used. The first measure is the industry's share of total county employment; the second is the industry's share of county earnings. Few time-varying control variables were available on an annual basis to measure the change in county characteristics. Annual population estimates from the U.S. Census were included as were the average annual changes in the proportion of high school and college graduates in the county. These latter variables were constructed from 1990 and 2000 census data. In addition, a number of control variables representing initial conditions are included in the estimation.

Since plant locations are not randomly assigned, this is not a true experimental design. There is some evidence that local officials do use tax abatements and other economic incentives to attract livestock processing firms and this may be one source of unobserved heterogeneity across counties. A major advantage of the first differenced approach is that any unobserved time invariant county fixed effects are removed from the estimation. However, there may still be time varying unobserved variables that are correlated with the presence of the livestock industry.

One method to control for potential nonrandom assignment of counties into the treatment group is to use instrumental variables that exogenously shift the probability of having a meatpacking plant but that do not directly affect growth rates in the county. The best candidates for instruments are factors that uniquely affect the productivity of a meatpacking plant, such as access to feed and animals, but have no obvious effect on the county growth rate. Since the industry generally serves national markets, variation in local demand is unlikely to provide identification. An alternative method involves a matching strategy in which a treatment group is paired with a control group based on similar values of explanatory variables (Angrist and Krueger 1999). Observations are matched using a propensity score, based on the predicted share of MPP jobs in the county in 1990. By creating a weighted sample of the control counties based on the distribution of propensity scores in the treated counties, we are able to generate a distribution of control counties that exactly matches the distribution of propensity scores in the treated counties. In contrast with closest neighbor matches, this method has the advantage of preserving all observations in the sample.

The weighted least squares estimator is given by:

$$\beta_{WLS} = (X'\Omega^{-1}X)^{-1}(X'\Omega^{-1}Y) \qquad (9)$$

where Y corresponds to $\ln Q_{it+1} - \ln Q_{it}$, X is a matrix of regressors including the change in the share of MPP share, $(\ln M_{it+1} - \ln M_{it})$, as well as changes in other exogenous factors, $(\ln X_{it+1} - \ln X_{it})$, and Ω is a diagonal matrix of weights, ω_i. Our main focus is to estimate the coefficient on $(\ln M_{it+1} - \ln M_{it})$, which is interpretable as the effect of MPP growth on our various measures of county growth.

We construct the weights in Ω using predicted MPP employment shares for each county in 1990. The weights reflect the number of counties in the treatment group (counties with MPP) relative to the number of matched counties in the control group (counties without MPP) where the match is based on comparable predicted MPP employment shares in the treatment and control counties.

To be precise, let T represent the treatment counties with meat packing plants at some point in the 1990-2000 period and C represent the control counties that never had an MPP plant in the period. The number of treatment counties is N_T, and the number of control counties is N_C. We regress 1990 MPP employment share in county i and group j, S_{ij} on a vector of observable attributes of the county in 1990, X_{ij}, that are believed to affect the probability of having a livestock processing plant,[4]

$$S_{ij} = X_{ij}'\Pi + \varepsilon_{ij}; \quad i = 1,2,...,N_j; \quad j = T,C \tag{10}$$

where Π is a vector of parameters that are common across the T and C groups. We then generate the predicted MPP employment share for each county, $\hat{S}_{ij}$. Figure 2.1 charts the distribution of $\hat{S}_{ij}$ for the two groups. The distributions are relatively well matched, with slightly more mass in the treatment distribution toward higher predicted shares. The considerable overlap in the distributions suggests that the non-host, non-metropolitan counties in the study states serve as a good control group for the host counties.

The weighting is used to make the control group distribution match the sample distribution of the treatment group. We order group T from smallest to largest $\hat{S}_{ij}$ and then subdivide group T into deciles. The lowest decile has $n_T = (N_T/10)$ observations with $\hat{S}_{ij}$ values ranging from $(-\infty, \hat{s}_{1T})$; the next decile also has n_T observations ranging from $(\hat{s}_{1T}, \hat{s}_{2T})$; and so on up to the highest decile of n_T observations ranging from $(\hat{s}_{9T}, +\infty)$. There is a corresponding number of control group counties lying in each range so that nc_1 counties lie within $(-\infty, \hat{s}_{1T})$; nc_2 lie within $(\hat{s}_{1T}, \hat{s}_{2T})$; and so on up to nc_{10} that lie within $(\hat{s}_{9T}, +\infty)$. In (9), each treatment group observation receives a weight of 1 in Ω while each control group observation is weighted by $\omega_i = nc_k/n_T$, for k=1...10. This method overweights control observations for which $nc_k<n_T$ and underweights control observations for which $nc_k>n_T$.[5]

The Sample

There are 858 non-metropolitan counties in the twelve Midwestern states included in this analysis. This region accounted for roughly one-third of the establishments and 40% of the employment and annual payroll in this industry in both 1990 and 2000. Some livestock processing industry was present in 376, or 44%, of these counties in 1990. By 2000, the number of counties with livestock processing had fallen slightly to 353, or 41% of these counties. In 1990, meat packing firms were present in 32% of the counties, 18% had meat processing firms, and 8% of the counties had poultry processing establishments. Figure 2.2 shows the distribution of counties by relative employment share of the industry in 1990. The livestock processing industry was present continuously between 1990 and 2000 in approximately one-third of the counties (288) in the sample. Eighty-eight counties lost the industry during the period while fifty-four gained it. In twenty-eight counties, the industry entered and exited during the study period.

In 1990, the average county with MPP presence had 241 jobs in the industry (Figure 2.3). The average industry employment for counties with poultry processing firms was much higher (507 employees on average) than for counties with meat packing (135 employees) or meat processing firms (146 employees). Average industry employment rose over the decade by about 46%; in 2000, the industry employed 352 employees in the average host county. For most counties with the industry, industry employment accounted for less than 1% of county employment; however, the share of industry employment ranged as high as 35%. Industry wages in counties with livestock processing firms averaged about $4.3 million, in 1990, rising to an average of $6.9 million (in inflation-adjusted, 1990 dollars) by 2000 (Figure 2.4). In most host counties, the industry represented less than one percent of the total county wage bill, but accounted for as much as 35% of total earnings for counties in the sample.

On average, in counties that had MPP industry jobs continuously throughout the decade, the industry employed 379 workers with an annual payroll of $8.2 million. The county with the largest continuous industry employment in the sample had nearly 5,400 MPP jobs. The largest wage bill was $156 million. Counties that gained the industry had an average of 70 industry jobs earning $1.4 million in wages, but ranged as high as 1,140 jobs and $21.5 million in wages. The size of the MPP industry was smaller in counties that lost or both gained and lost industry jobs between 1990 and 2000. Only 29 workers were employed on average in the counties that ultimately lost the industry, earning an average $0.5 million annually. Yet, in this group, the county with the largest industry employment had 658 workers employed in meat packing or processing. This is similar to counties that both gained and lost the industry; an average 34 workers earning slightly more than $0.5 million annually were employed in the industry in these counties. The county with the largest industry employment in this group of counties had 427 people employed in the industry.

Results

Tables 2.2 through 2.4 summarize the regression results for equations (7) and (8). Our measures of local endowments that might affect growth independent of the presence of the meat packing and processing industry include: 1990 values of county population, employment, income and average wage, percent of the population with a high school education, percent of the population with a college education, poverty rate, property crime and violent crime rates, the presence of an interstate highway, and the USDA natural amenities scale. The annual county population growth rates and average annual rate of change in the proportion of high school and college educated populations are also included as explanatory variables. Complete regression results are provided in Appendix 2B[6]. Columns (1) and (2) present estimates from ordinary least squares regressions. Results using two different measures of industry size are reported: employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of the MPP industry's wage bill in the county. Since plant location may not be randomly determined, the ordinary least squares estimates may be biased measures of the impact of the growth in MPP employment share on county economic and social outcomes. Columns (3) and (4) provide estimates from weighted least squares regressions, using the propensity score matching technique described above to construct weights[7].

The estimates in table 2.2 suggest that growth of the MPP industry as a share of total county employment raises county employment growth, while lowering wage growth. The negative wage effect appears to swamp the positive employment effect, resulting in lower income growth. Net employment (total county employment minus MPP industry employment) slows as the industry grows in relative importance in the county, suggesting that growth in the MPP industry may deter additional job growth in the county. The magnitudes of the implied changes are very small, however. The coefficients, which can be interpreted as elasticities, are generally less than one, meaning a one percent increase in the industry's employment share in year t relative to year t-1 leads to a corresponding change in the outcome variable that is less than one-percent.

The results provide little evidence that the growth in the relative share of the meat packing/processing industry affects government spending or crime rates. The estimates suggest that host counties have relatively faster growth in total government expenditures, but the difference is very small and the coefficients are measured imprecisely. There is no significant effect of industry growth on the growth in crime rates. That said, the negative sign suggests that growth in the industry lowers the rate of change in violent crime as opposed to increasing it, a charge commonly leveled against the industry in existing case study literature.[8]

When the effects of growth in the MPP industry are allowed to vary according to whether the industry entered, exited or was present continuously throughout the decade, some differences emerge. These results are presented in table 2.3. The first four rows of estimates correspond to δc, the coefficient on the growth in the share of the meatpacking and processing industry in equation (8) for counties that had the industry continuously throughout the decade (relative to counties that never had the industry during the same time period). The first two rows provide estimates from the ordinary least squares regressions, one set using employment share to measure the MPP industry and the second set using wage share. The second two rows present similar estimates from weighted least squares regressions. The second set of estimates correspond to δ_G, the effect of industry growth in counties that gained the industry; the third set are estimates of δ_L, the coefficients on industry growth for counties that lost the industry, and the final set are δ_B, for the set of counties that both gained and lost the industry during the decade.

The negative effect of an increasing share of MPP industry on income growth appears to be driven mainly by counties that both gained and lost the industry over the decade. When industry size is measured by its share of the total county wage bill, the results suggest that the industry also slowed income growth in counties that had MPP jobs continuously throughout the decade. In counties that lost the industry, income growth was higher before the loss of the MPP jobs, although not significantly higher.

Counties that gained the MPP industry experienced faster employment growth, as did counties that had the industry continuously during the study period. Counties that lost the industry had higher employment growth before losing the plant, but the estimates are imprecise. Net employment growth was relatively slower in counties that had the industry continuously and in counties that lost the industry. While the coefficients on net employment growth are likewise negative for counties that gained MPP jobs, the estimates are not significant. There is no evidence that growth in the relative share of the industry affects growth in crime rates or local government expenditures whether the industry was present continuously, entered, exited or both entered and exited over the sample period.

Table 2.4 presents the weighted least squares estimates of δ for more detailed classifications of the industry. Columns (1) and (2) provide estimates for all MPP industries combined; columns (3) and (4) give estimates for the packing industry only (NAICS 311611), columns (5) and (6) provide estimates for the poultry processing industry only (NAICS 311615) and estimates for the processing industry (NAICS 311612, 311613 and 311412) are presented in the remaining columns. In each case, results are shown for the two measures of the MPP industry; growth in the proportion of industry employment share and growth in the proportion of industry wage share in the county.

The results do not differ markedly when these more detailed industry classifications are used to define treatment county status. In general the signs of the coefficients for income, wages, employment and net employment are consistent across industry type although the significance levels vary. In the meat processing and poultry processing equations, growth in the relative employment share does not lower significantly income growth as it does in the meat packing equations. In addition, the negative effects on wage growth and net employment growth are significant only for the meat packing industry. Positive employment growth effects are significant only in the processing industry equations. While growth in the share of poultry processing tends to slow government expenditures relative to counties without the industry, these estimates do not provide only limited support for the notion that growth in the meat packing and processing industry significantly impacts government spending.

Conclusions

Growth in the meat packing and processing industry in the Midwestern United States has generated a significant amount of debate regarding the costs and benefits of this type of economic development. Previous studies, employing a case study approach, have documented both positive and negative consequences following the opening of large meat packing plants, but generally have failed to provide a frame of reference for evaluating these changes. Our goal was to provide this frame of reference by assessing the changes in economic and social outcomes resulting from growth (or decline) in the meat packing and processing industry relative to changes in similar settings without meat industry jobs. Using a broad array of social and economic growth indicators, we find neither the large systematic gains envisioned by proponents of MPP expansion, nor the significant losses feared by the industries' opponents.

Local officials seek to attract the meat packing and processing industry because they believe it will generate employment and spur wage growth in their communities. This research does find evidence that the industry affects total county employment growth, but does not support the case for positive spillovers on employment in other sectors or on wage growth. Instead, we find that expansion in meat packing and processing has a negative effect on overall wage growth and slows employment growth in other sectors of the host county economy. There is some evidence that the slower wage growth swamps the faster employment growth so that aggregate income grows more slowly. In contrast to previous studies, there is no systematic effect of growth in the industry on either local crime rates or local government spending.

Counties that lost the MPP industry did not have appreciable changes in employment growth. Apparently, firms in other sectors were able to absorb labor shed by the shuttered MPP firms. Counties that gained the industry had significantly faster employment growth, but no appreciable advantage in any of the other growth measures. On the other hand, there is no evidence of more rapid growth of crime in counties gaining MPP firms. Finally, examining the impacts by industry reveals some differences between meat packing facilities and higher-value processing plants. In particular, expansion in the packing industry lowers wage, income growth and net employment growth, without the accompanying increase in total employment growth seen in the estimates for all industries combined. Growth in the meat processing industry appears to spur total employment growth, while not significantly impacting wages or employment in other sectors.

This research helps provide a context for evaluating the impact of the livestock processing industry on rural communities in the Midwestern U.S. As the industry continues to expand in rural America, further research will be needed to address questions regarding its effect on environmental quality and other quality of life aspects not addressed in this study.

Endnotes

[1] This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data on-site at BLS. The views expressed here are those of the authors and do not necessarily reflect the views of the BLS.

[2] Data from the 2001 County Business Patterns show 64% of Poultry Processing firms had more than 100 employees; 17% had 1,000 employees or more. Only 8% of Animal (except poultry) Slaughtering firms have

over 100 employees; 20% of firms classified as 'Meat Processed from Carcasses' and 6% of Rendering and Meat By-product Processing firms are as large.

[3] The data are not publicly available, but research using the data was permitted upon approval of an application to the Department of Labor. Only the aggregated results may be released to the public. The research was carried out at the Bureau of Labor Statistics (BLS) in Washington, D.C. in 2004. (See http://www.bls.gov/bls/blsresda.htm for more details.)

[4] These regression results are available upon request from the authors. We experimented with propensity scores based on the presence or absence of an MPP plant as opposed to the employment share. The fit of the probit was poor, generating few significant coefficients, suggesting that the presence of a plant was close to a random event. Employment share equations provided greater variation in the dependent variable and a better fit.

[5] This is a type of conditional difference-in-difference matching estimator (Heckman, Ichimura and Todd 1997).

[6] The addition of control variables does little to change the estimates. Comparing Table B1 and B2, only seven of the eighty coefficients change significance between the two tables. In general the addition of control variables strengthens the results rather than mitigating them. This is perhaps not surprising given the empirical specification. A major advantage of the first-difference approach is that it eliminates county specific unobservables that may affect growth. Adding additional county-level controls provides little new information. The discussion of the results will refer to the specifications including control variables. The results from specifications without controls are included in Appendix for interested readers.

[7] As it turns out, our results are not sensitive to the type of estimation strategy used. The results from ordinary least squares are available from the authors upon request.

[8] As Otto, Orazem and Huffman point out in an analysis of the community and economic impacts of the hog industry in Iowa, it is the relative change in crime rates that matters. Although crime may be rising in counties with a meat packing plant, if crime rates are rising in all other counties as well, the rise in crime can not be attributed to the presence of the packing plant. "Numerous complaints have been registered regarding increases in criminal activity in areas that have meat packing plants. Incidence of violent crime rose 56 percent in Louisa County between 1980 and 1990. However, this is only a marginally greater increase in criminal activity than the statewide increase of 49 percent during the same period. More telling, violent crimes rates rose an average of 168 percent in the seven counties that lost meat packing plants. So if meat packing is to be associated with increased criminal activity, it is the loss of the industry rather than its expansion that is to blame."

References

Angrist, Joshua D. and Alan B. Krueger. 1999. "Empirical Strategies in Labor Economics." Chapter 23 in O. Ashenfelter and D. Card (Eds.), *The Handbook of Labor Economics*, Vol III. North Holland.

Barkema, Alan, Mark Drabenstott and Nancy Novack. 2001. "The New U.S. Meat Industry." *Economic Review*, Second Quarter, Kansas City Federal Reserve Bank: 33-56.

Benson, Janet E. "Staying Alive: Economic Strategies Among Immigrant Packing Plant Workers in Three Southwest Kansas Communities." *Kansas Quarterly:* 107-120.

Broadway, Michael. 1990. "Meatpacking and Its Social and Economic Consequences for Garden City, Kansas in the 1980s." *Urban Anthropology* Vol 19(4):321-344.

Broadway, Michael. 1994. "Beef Stew: Cattle, Immigrants and Established Residents in a Kansas Beefpacking Town." Chapter 2 in L. Lamphere, A. Stepick and G. Grenier (Eds.), *Newcomers In the Workplace: Immigrants and the Restructuring of the U.S. Economy*. Philadelphia, PA: Temple University Press, p. 25-43.

Broadway, Michael. 2000. "Planning for change in small towns or trying to avoid the slaughterhouse blues." *Journal of Rural Studies* 16: 37-46.

Broadway, Michael, Donald D. Stull and Bill Podraza. 1994. "What Happens When the Meat Packers Come to Town?" *Small Town* (January-February):24-27.

Des Moines Register, 2000. "Listen to the Cattlemen." August 6.

Drabenstott, Mark, Mark Henry and Kristin Mitchell. 1999. "Where Have All the Packing Plants Gone? The New Meat Geography in Rural America." *Economic Review*, Third Quarter, Kansas City Federal Reserve Bank: 65-82.

Eckhoff, J. 2000. "D. M. Officials Uncertain About New Packing Plant." *Des Moines Register*, April 4, pp. 1B.

Edmiston, Kelly. 2004. "The Net Effects of Large Plant Locations and Expansions on County Employmnent." *Journal of Regional Science* 44(2):289-319.

Flora, Cornelia Butler, Jan L. Flora and Ruben J. Tapp. "Meat, Meth, and Mexicans: Community Responses to Increasing Ethnic Diversity." *Journal of Community Development Society* 31:2(2000): 277-299.

Fox, William F. and Matthew N. Murray. 2004. "Do Economic Effects Justify the Use of Fiscal Incentives?" *Southern Economic Journal* 71(1):78-92.

Glaeser, Edward L., Hedi D. Kallal, Jose A. Scheinkman, and Andrei Shleifer. 1992. "Growth in Cities." *Journal of Political Economy* 100(61):1126-1152.

Glaeser, Edward L., Jose A. Scheinkman, and Andrei Shleifer. 1995. "Economic Growth in a Cross-Section of Cities." *Journal of Monetary Economics* 36:117-143.

Grey, Mark A. 1997a. "Secondary Labor in the Meatpacking Industry: Demographic Change and Student Mobility in Rural Iowa Schools." *Journal of Research in Rural Education* 13 (Winter): 153-164.

Grey, Mark A. 1997b. "Storm Lake, Iowa, and the Meatpacking Revolution: Historical and Ethnographic Perspectives on a Community in Transition." In S. Stromquist and M. Bergman (Eds.), *Unionizing the Jungles: Labor and Community in the Twentieth-Century Meatpacking Industry*. Iowa City, IA: University of Iowa Press, p. 242-261.

Grey, Mark A. 1999. “Immigrants, Migration, and Worker Turnover at the Hog Pride Pork Packing Plant.” *Human Organization* 58(1):16-27.

Greenstone, Michael and Enrico Moretti. 2003. “Bidding for Industrial Plants: Does Winning a ‘Million Dollar Plant’ Increase Welfare?” NBER Working Paper 9844, July.

Hackenberg, Robert A. 1995. “Conclusion: Joe Hill Died For Your Sins: Empowering Minority Workers in the New Industrial Labor Force.” Chapter 11 in D. Stull, M. Broadway and D. Griffith (Eds.), *Any Way You Cut It: Meat Processing and Small-Town America*. Lawrence, KS: University of Kansas Press.

Heckman, J.J., H. Ichimura, and P.E. Todd. 1997. “Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme.” *The Review of Economic Studies* 64: 605-654.

Hotchkiss, Julie L., Robert E. Moore and Stephanie M. Zobay. 2003. “Impact of the 1996 Summer Olympic Games on Employment and Wages in Georgia.” *Southern Economic Journal* 69(3): 691-704.

Huffman, Wallace E. and John A. Miranowski. 1996. “Immigration, Meat Packing, and Trade: Implications for Iowa.” Staff Paper #285, December.

Leistritz, F. Larry and Randall S. Sell. 2001. “Socioeconomic Impacts of Agricultural Processing Plants.” *Journal of the Community Development Society* 32(1):130-159.

Otto, Daniel, Peter Orazem and Wallace Huffman. 1998. “Community and Economic Impacts of the Iowa Hog Industry.” Chapter 6 in *Iowa's Pork Industry – Dollars and Scents*. Ames, IA: Agriculture and Home Economics Experiment Station, PM-1746, p.25-28.

Schlosser, Eric. 2002. Fast Food Nation. New York, NY: Perennial.

Table 2.1. Definitions and Sources of Variables

Variable	Description	Source
Dependent Variables		
incdif	Log difference in county total real personal income	BEA
Wagesdif	Log difference in average county real wages (Earnings / Wage and Salary Employment)	BEA
Empdif	Log difference in county employment	BEA
NetEmpdif	Log difference in county employment minus industry employment	BEA, LDB
Getotdif	Log difference in total direct local government expenditures	Census of Govt.
Geedudif	Log difference in direct local government expenditures on education	Census of Govt.
Gepolicedif	Log difference in direct local government expenditures on police protection	Census of Govt.
Gehealthdif	Log difference in direct local government expenditures on health and hospital	Census of Govt.
Pcratedif	Log difference in property crime rates	FBI Uniform Crime Reports
Vcratedif	Log difference in violent crime rates	FBI Uniform Crime Reports
Measures of the Meat Processing Industry		
Indempshare	County meat processing employment/Total county employment	LDB, BEA
Indempsharedif	Log difference in Indempshare	LDB, BEA
Indwageshare	County meat processing wage bill /Total county earnings	LDB, BEA
Indwagesharedif	Log difference in Indwageshare	LDB, BEA
Control Variables		
bcollrate	Percent of county population with bachelor's degree or higher	U.S. Census
bhsrate	Percent of county population with a high school diploma or equivalent, but not a college degree	U.S. Census
bpovrate	Percent of county population with incomes below poverty, 1990	U.S. Census
bemp	Total wage and salary employment, 1990	BEA
bwage	Average county real wage (Earnings / Wage and Salary Employment), 1990	BEA
bpop	County population, 1990	U.S. Census
bincome	County real personal income, 1990	BEA
bpcrate	Number of property crimes per 1,000 population, 1990	FBI Uniform Crime Reports
bvcrate	Number of violent crimes per 1,000 population, 1990	FBI Uniform Crime Reports
amenities	USDA Natural Amenities Index	USDA
interstate	Presence of an interstate highway	ESRI, ArcView Version 3.2

Table 2.2. Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators

	OLS		WLS	
Dependent Variable	**Employment Share (1)**	**Wage Share (2)**	**Employment Share (3)**	**Wage Share (4)**
Income	-0.16***	-0.57***	-0.21***	-0.60***
	(2.65)	(6.02)	(4.28)	(5.94)
Wage	-0.33	-1.15***	-0.33*	-1.07***
	(1.57)	(3.61)	(1.81)	(2.88)
Employment	0.16***	0.32***	0.09**	0.28**
	(3.79)	(4.90)	(2.36)	(3.52)
Net Employment	-0.15***	-0.42***	-0.04	-0.25***
	(3.74)	(6.53)	(1.17)	(3.21)
Total Govt. Exp.	0.03	0.04	0.03	0.04
	(0.65)	(0.62)	(0.77)	(0.58)
Education Govt. Exp.	0.03	0.04	0.02	0.04
	(0.71)	(0.71)	(0.90)	(0.69)
Police Govt. Exp.	0.07	0.07	0.09	0.10
	(0.38)	(0.23)	(0.61)	(0.35)
Health Govt. Exp.	-0.45	-1.85	-0.05	-1.07
	(0.24)	(0.61)	(0.05)	(0.44)
Property Crime Rate	0.42	-2.05	0.31	-2.05
	(0.07)	(0.36)	(0.05)	(0.36)
Violent Crime Rate	-2.84	-4.88	-3.15	-5.07
	(0.31)	(0.58)	(0.31)	(0.54)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of the MPP industry's wage bill in the county. Columns (1) and (2) report estimates from ordinary least squares regressions. Columns (3) and (4) report results from weighted least squares regressions where the weights are derived using a propensity score matching technique. See text for further details.

Table 2.3. Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators by Timing of Industry Presence

	Dependent Variable									
	Income	Wage	Employ-ment	Net Employ-ment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
Continuous Presence of Industry										
OLS										
Employment Share	0.01	-0.31	0.46***	-0.82***	0.04	0.02	-0.06	-0.67	-0.43	-1.93
	(0.10)	(0.67)	(5.12)	(9.09)	(0.37)	(0.29)	(0.13)	(0.15)	(0.06)	(0.18)
Wage Share	-0.64***	-1.32***	0.32***	-0.60***	0.04	0.04	0.04	-0.88	-2.74	-3.86
	(5.66)	(3.36)	(4.24)	(7.89)	(0.52)	(0.56)	(0.10)	(0.24)	(0.45)	(0.43)
WLS										
Employment Share	0.01	-0.30	0.47***	-0.82***	0.04	0.04	-0.01	-1.08	-0.40	-1.12
	(0.05)	(0.43)	(3.31)	(5.72)	(0.31)	(0.35)	(0.01)	(0.24)	(0.06)	(0.10)
Wage Share	-0.65***	-1.31***	0.33***	-0.60***	0.05	0.05	0.11	-1.25	-2.70	-3.21
	(4.11)	(2.19)	(2.75)	(4.95)	(0.43)	(0.56)	(0.25)	(0.32)	(0.44)	(0.32)
Gained Industry										
OLS										
Employment Share	0.48	-0.63	1.26***	-0.07	0.06	-0.11	-0.55	-11.73	-3.66	-9.33
	(1.19)	(0.45)	(4.61)	(0.27)	(0.22)	(0.44)	(0.41)	(0.89)	(0.12)	(0.20)
Wage Share	0.14	-1.14	1.35***	-0.14	0.19	-0.15	-0.74	-13.48	-4.10	-10.43
	(0.31)	(0.70)	(4.27)	(0.45)	(0.56)	(0.53)	(0.48)	(0.88)	(0.14)	(0.24)
WLS										
Employment Share	0.51	-0.57	1.31***	-0.06	-0.02	-0.12	-0.36	-9.09	-2.82	-4.79
	(1.57)	(0.47)	(5.25)	(0.22)	(0.08)	(0.67)	(0.39)	(1.14)	(0.11)	(0.12)
Wage Share	0.32	-0.90	1.48***	-0.10	0.06	-0.14	-0.47	-10.54	-2.71	-6.39
	(0.83)	(0.62)	(5.02)	(0.36)	(0.24)	(0.70)	(0.43)	(1.12)	(0.12)	(0.17)

Table 2.3. (continued)

	Income	Wage	Employ-ment	Net Employ-ment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
Lost Industry										
OLS										
Employment Share	0.29	0.18	0.32	-0.77***	-0.08	0.00	-0.35	-2.55	4.09	-2.81
	(0.77)	(0.13)	(1.25)	(3.03)	(0.30)	(0.01)	(0.28)	(0.21)	(0.23)	(0.07)
Wage Share	0.21	0.16	0.20	-0.94***	-0.15	-0.04	-0.48	-1.74	3.64	-12.02
	(0.48)	(0.11)	(0.68)	(3.26)	(0.49)	(0.17)	(0.34)	(0.12)	(0.14)	(0.31)
WLS										
Employment Share	0.31	0.16	0.34	-0.75*	-0.06	0.00	-0.19	-1.98	4.18	-4.53
	(0.60)	(0.08)	(0.85)	(1.87)	(0.17)	(0.01)	(0.13)	(0.15)	(0.23)	(0.15)
Wage Share	0.23	0.16	0.22	-0.91**	-0.13	-0.04	-0.25	-1.25	3.61	-14.62
	(0.38)	(0.07)	(0.49)	(2.02)	(0.33)	(0.12)	(0.15)	(0.09)	(0.14)	(0.34)
Both Gained and Lost										
OLS										
Employment Share	-0.30***	-0.37	0.01	-0.01	0.01	0.00	0.01	0.17	1.07	-3.26
	(4.49)	(1.60)	(0.11)	(0.22)	(0.28)	(0.02)	(0.05)	(0.08)	(0.23)	(0.07)
Wage Share	-0.87***	-1.09*	0.03	-0.04	0.01	-0.02	-0.03	0.22	1.37	-7.24
	(4.79)	(1.72)	(0.23)	(0.36)	(0.11)	(0.15)	(0.04)	(0.04)	(0.03)	(0.12)
WLS										
Employment Share	-0.31***	-1.12**	0.00	-0.01	0.02	0.00	0.00	0.17	0.37	-4.41
	(6.03)	(2.10)	(0.09)	(0.19)	(0.52)	(0.17)	(0.01)	(0.14)	(0.01)	(0.09)
Wage Share	-0.90***	-1.09*	0.02	-0.03	0.03	0.00	-0.03	0.35	0.33	-8.36
	(6.39)	(1.72)	(0.20)	(0.26)	(0.36)	(0.04)	(0.08)	(0.10)	(0.01)	(0.12)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000. OLS refers to ordinary least squares regressions. WLS refers to weighted least squares regressions where the weights are derived using a propensity score matching technique. See text for further details.

Table 2.4. Weighted Least Squares Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators by Detailed Industry Classification

	All Industries		Packing		Poultry		Processing	
Dependent Variable	**Emp. Share (1)**	**Wage Share (2)**	**Emp. Share (3)**	**Wage Share (4)**	**Emp. Share (5)**	**Wage Share (6)**	**Emp. Share (7)**	**Wage Share (8)**
Income	-0.26***	-0.68***	-0.29***	-0.71***	0.30	-0.28	0.44	0.16
	(5.35)	(6.81)	(5.53)	(6.03)	(0.47)	(0.38)	(1.49)	(0.47)
Wage	-0.37**	-1.13***	-0.35*	-0.96***	0.31	-0.79	-0.51	-1.00
	(2.01)	(3.00)	(1.81)	(2.16)	(0.14)	(0.32)	(0.46)	(0.88)
Employment	0.07*	0.25**	0.02	0.14	0.59	0.66	1.20***	1.23***
	(1.89)	(3.31)	(0.62)	(1.52)	(1.47)	(1.43)	(5.22)	(4.78)
Net Employment	-0.07*	-0.28***	-0.05	-0.23***	-0.51	-0.49	-0.13	-0.16
	(1.81)	(3.70)	(1.23)	(2.58)	(1.28)	(1.07)	(0.56)	(0.63)
Total Govt. Exp.	0.02	0.04	0.04	0.12	-1.04***	-1.18***	-0.08	-0.10
	(0.55)	(0.56)	(0.96)	(1.44)	(2.61)	(2.58)	(0.39)	(0.47)
Educ. Govt. Exp.	0.00	0.01	0.003	0.02	-0.34	-0.22	-0.10	-0.10
	(0.05)	(0.10)	(0.12)	(0.31)	(0.94)	(0.51)	(0.51)	(0.49)
Police Govt. Exp.	0.02	0.03	0.02	-0.01	0.62	1.19	-0.24	-0.28
	(0.12)	(0.10)	(0.10)	(0.01)	(0.47)	(0.78)	(0.25)	(0.25)
Health Govt. Exp.	-0.18	-1.11	0.41	0.72	-1.63	-3.62	-8.22	-8.76
	(0.15)	(0.45)	(0.29)	(0.23)	(0.09)	(0.17)	(1.05)	(0.99)
Property Crime Rate	0.10	-2.32	-0.85	-1.00	2.39	0.99	0.17	-3.17
	(0.02)	(0.41)	(0.09)	(0.11)	(0.09)	(0.03)	(0.01)	(0.29)
Violent Crime Rate	-2.11	-4.12	-1.25	-1.98	0.61	-1.69	-5.77	-9.02
	(0.21)	(0.44)	(0.08)	(0.13)	(0.02)	(0.04)	(0.25)	(0.48)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Column (1) presents estimates for all MPP industries combined; column (2) shows estimates for the packing industry only (NAICS 311611), column (3) provides estimates for the poultry processing industry only (NAICS 311615) and estimates for the processing industry (NAICS 311612, 311613 and 311412) are presented in the remaining columns.

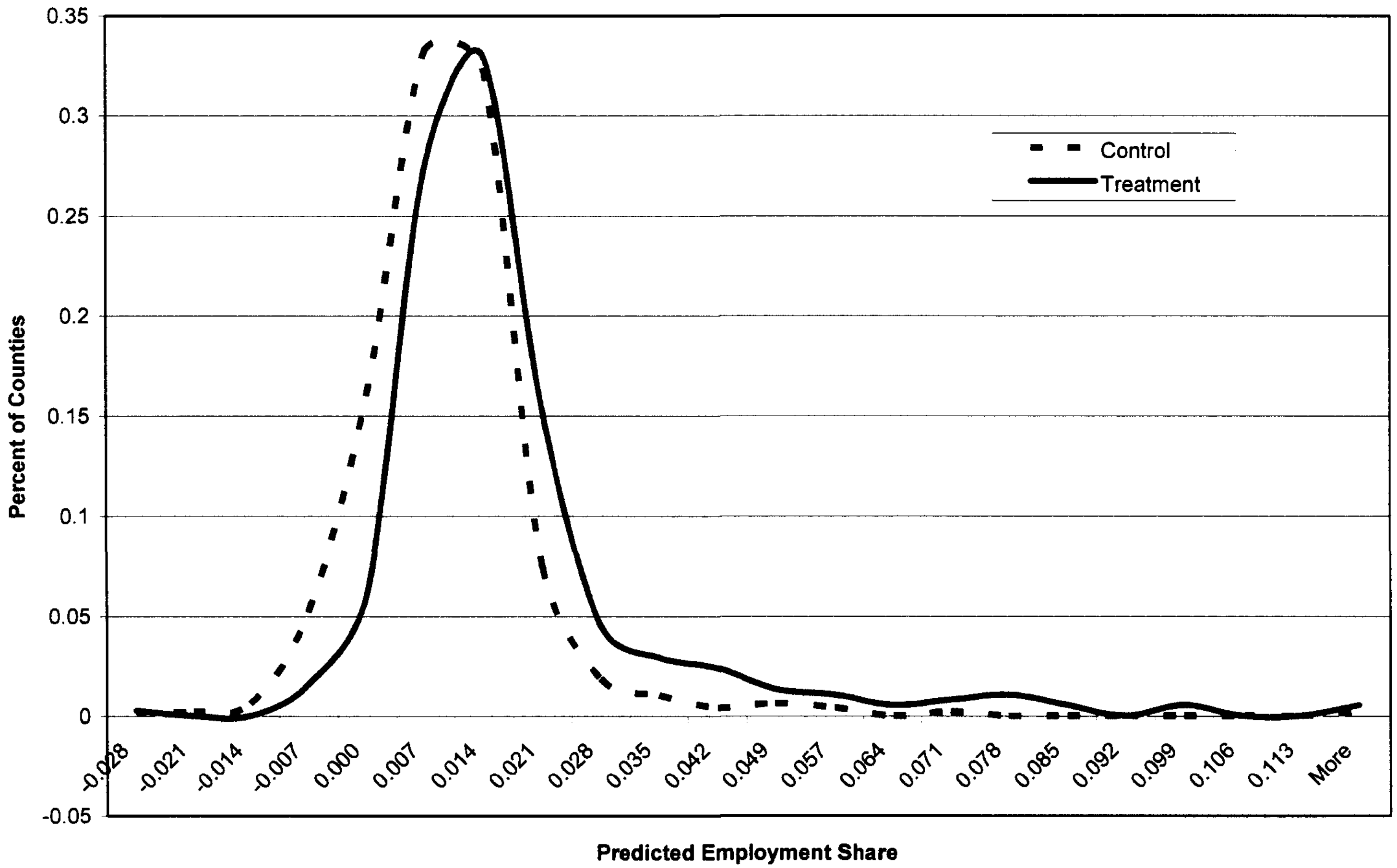

Figure 2.1. Distribution of Predicted Livestock Processing Employment Share in 1990: Treatment Counties versus Control Counties

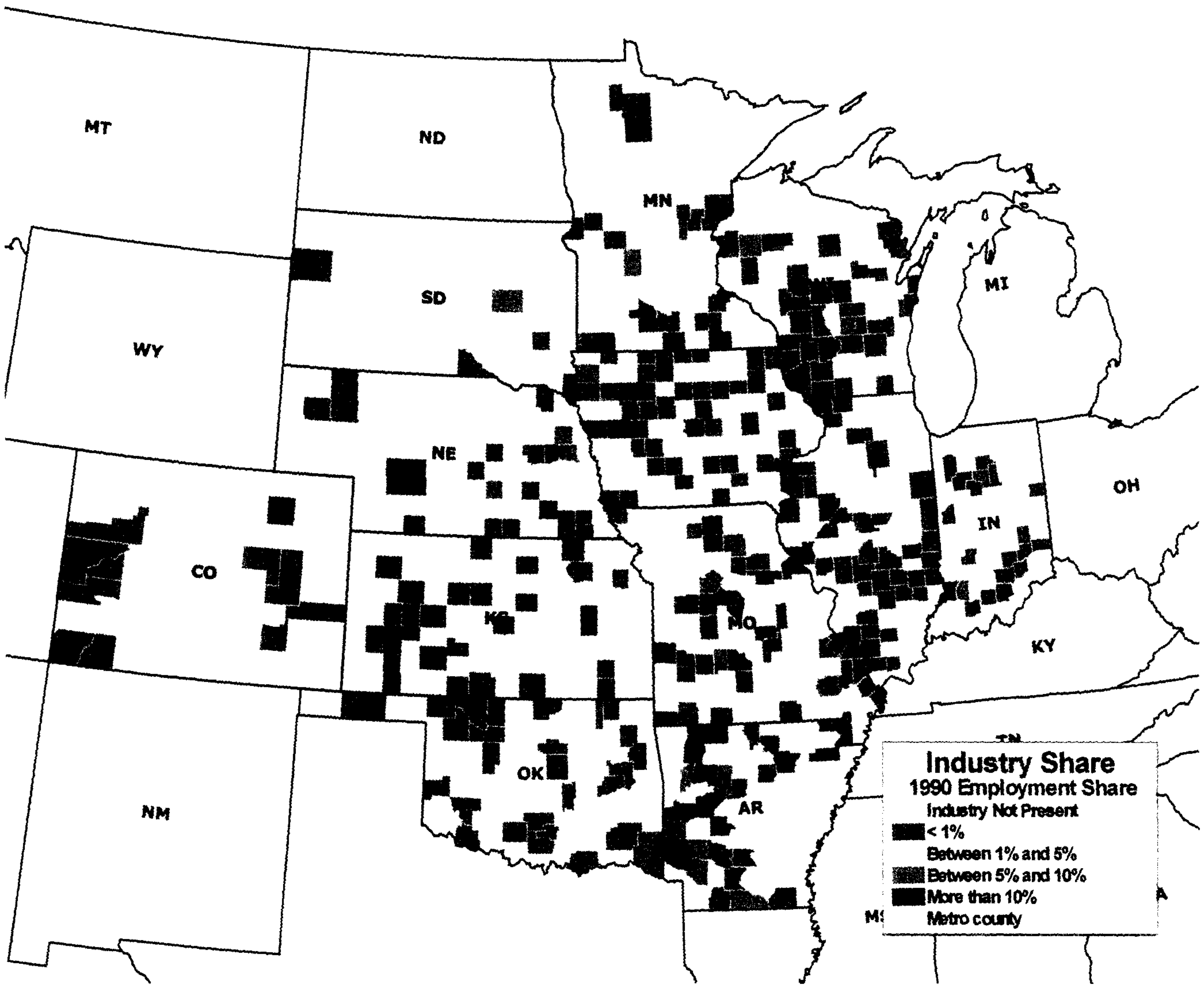

Figure 2.2. 1990 Meat Packing & Processing Industry's Share of Total County Employment

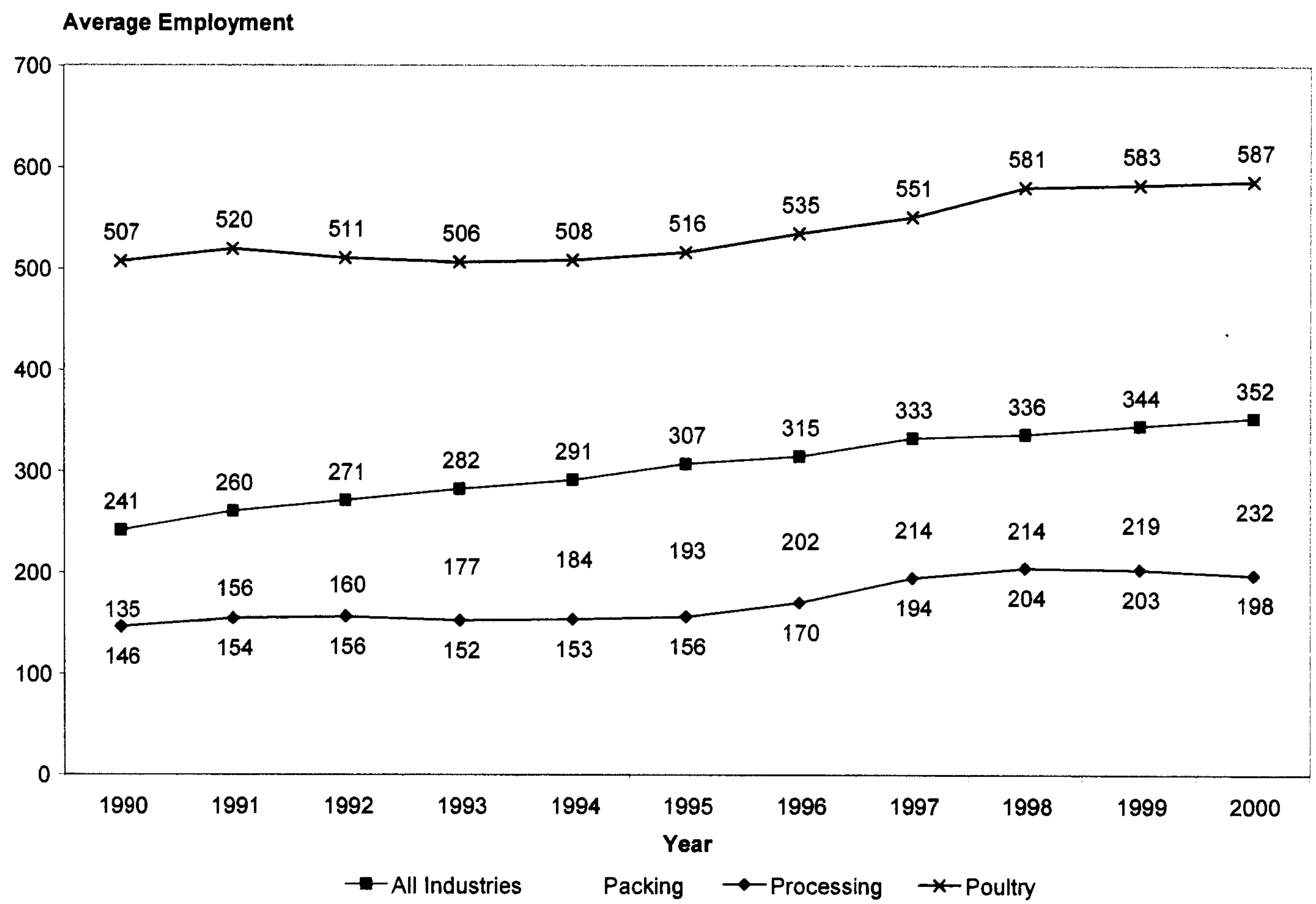

Figure 2.3. Average County Employment in the Industry, 1990-2000

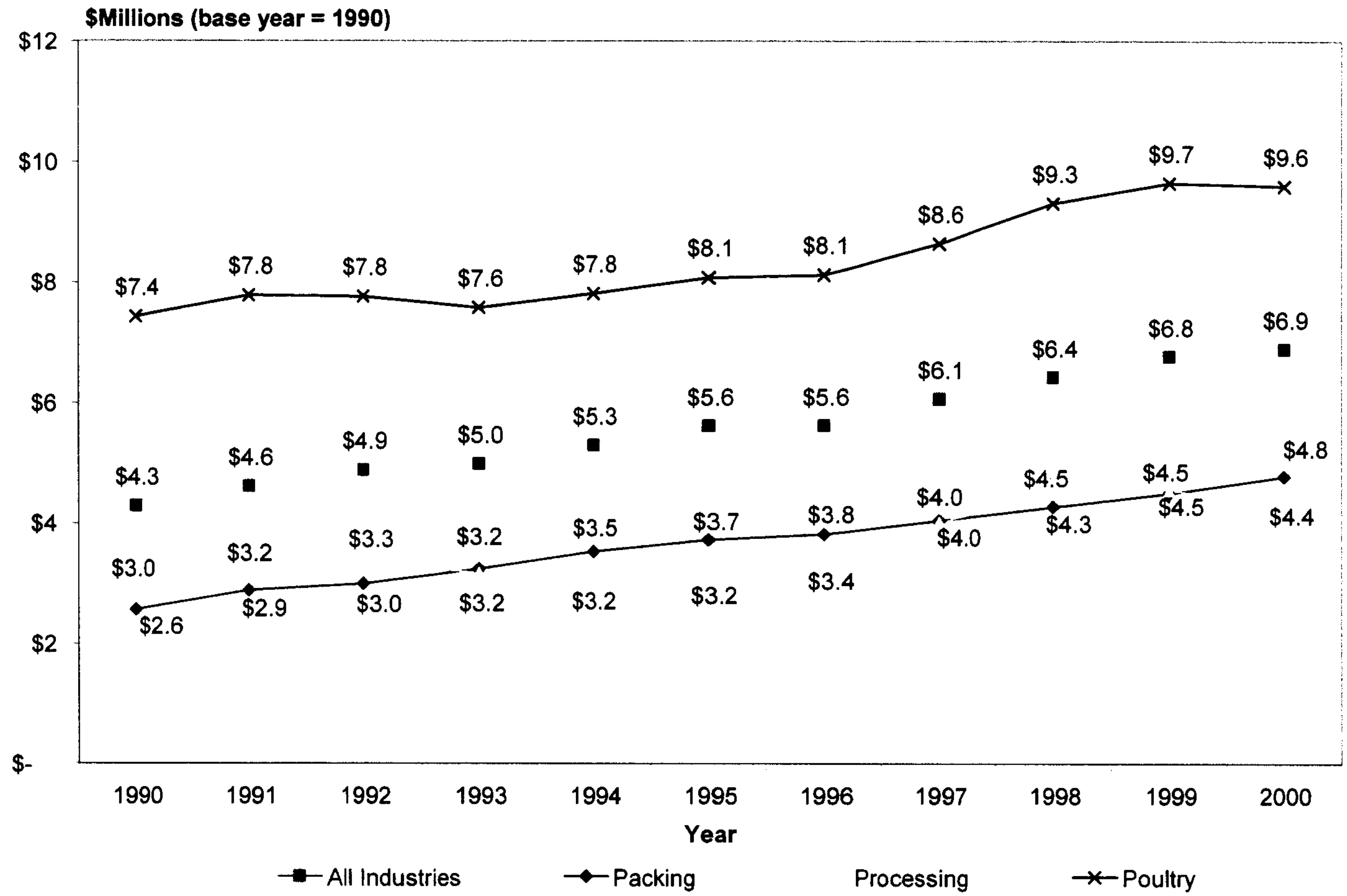

Figure 2.4. Average County -Industry Wage Bill

Appendix 2A: Description of Industries

NAICS 311611: Animal (except Poultry) Slaughtering. This U.S. industry comprises establishments primary engaged in slaughtering animals (except poultry and small game). Establishments that slaughter and prepare meats are included in this industry.

NAICS 311612: Meat Processed from Carcasses. This U.S. industry comprises establishments primarily engaged in processing or preserving meat and meat byproducts (except poultry and small game) from purchased meats. This industry includes establishments primarily engaged in assembly cutting and packing of meats (i.e., boxed meats) from purchased meats.

NAICS 311613: Rendering and Meat Byproduct Processing. This U.S. industry comprises establishments primarily engaged in rendering animal fat, bones, and meat scraps.

NAICS 311615: Poultry Processing. This U.S. industry comprises establishments primarily engaged in (1) slaughtering poultry and small game and/or (2) preparing processed poultry and small game meat and meat byproducts

NAICS 311412: Frozen Specialty Food Manufacturing. This U.S. industry comprises establishments primarily engaged in manufacturing frozen specialty foods (except seafood), such as frozen dinners, entrees, and side dishes; frozen pizza; frozen whipped topping; and frozen waffles, pancakes, and french toast.

Appendix 2B: Supplemental Tables

Table 2B.1. OLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators, No Controls

	All Industries		Packing		Poultry		Processing	
Dependent Variable	**Employment Share (1)**	**Wage Share (2)**	**Employment Share (3)**	**Wage Share (4)**	**Employment Share (5)**	**Wage Share (6)**	**Employment Share (7)**	**Wage Share (8)**
Income	-0.16***	-0.57***	-0.20***	-0.51***	0.35	-0.65**	0.18	-0.71***
	(2.65)	(6.02)	(3.22)	(4.65)	(1.25)	(2.31)	(0.69)	(3.12)
Wage	-0.33	-1.15***	-0.33*	-0.91**	-0.04	-1.91**	-0.32	-1.61**
	(1.57)	(3.61)	(1.55)	(2.43)	(0.04)	(2.03)	(0.37)	(2.11)
Employment	0.16***	0.32***	0.09**	0.24***	0.90***	0.82***	0.61***	0.33**
	(3.79)	(4.90)	(2.12)	(3.11)	(4.72)	(4.27)	(3.43)	(2.10)
Net Employment	-0.15***	-0.42***	-0.13***	-0.44***	-0.27	-0.13	-0.59***	-0.55***
	(3.74)	(6.53)	(2.84)	(5.78)	(1.43)	(0.69)	(3.33)	(3.53)
Total Govt. Exp.	0.03	0.04	0.06	0.15*	-0.31	-0.33	-0.22	-0.17
	(0.65)	(0.62)	(1.33)	(1.88)	(1.48)	(1.60)	(1.16)	(0.99)
Educ. Govt. Exp.	0.03	0.04	0.05	0.09	0.01	0.06	-0.29*	-0.18
	(0.71)	(0.71)	(1.18)	(1.31)	(0.07)	(0.35)	(1.72)	(1.21)
Police Govt. Exp.	0.07	0.07	0.08	-0.02	0.32	1.01	-0.25	-0.17
	(0.38)	(0.23)	(0.40)	(0.04)	(0.35)	(1.10)	(0.30)	(0.22)
Health Govt. Exp.	-0.45	-1.85	-0.05	0.85	-1.90	-2.44	-6.08	-5.61
	(0.24)	(0.61)	(0.02)	(0.24)	(0.21)	(0.27)	(0.74)	(0.77)
Property Crime Rate	0.42	-2.05	0.24	-0.06	1.55	-3.07	-1.79	-4.13
	(0.07)	(0.36)	(0.03)	(0.01)	(0.16)	(0.30)	(0.12)	(0.39)
Violent Crime Rate	-2.84	-4.88	-1.75	-2.27	-0.31	-1.43	-10.47	-12.53
	(0.31)	(0.58)	(0.13)	(0.18)	(0.02)	(0.09)	(0.49)	(0.80)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county.

Table 2B.2. OLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators

	All Industries		Packing		Poultry		Processing	
Dependent Variable	**Employment Share (1)**	**Wage Share (2)**	**Employment Share (3)**	**Wage Share (4)**	**Employment Share (5)**	**Wage Share (6)**	**Employment Share (7)**	**Wage Share (8)**
Income	-0.21***	-0.63***	-0.26***	-0.60***	0.29	-0.72***	0.29	-0.65***
	(3.49)	(6.79)	(4.22)	(5.54)	(1.05)	(2.62)	(1.16)	(2.94)
Wage	-0.34	-1.17***	-0.36*	-0.95***	-0.01	-1.89**	-0.25	-1.57**
	(1.68)	(3.69)	(1.69)	(2.54)	(0.01)	(2.00)	(0.29)	(2.05)
Employment	0.13***	0.28**	0.06	0.19***	0.84***	0.77***	0.68***	0.36***
	(3.23)	(4.55)	(1.37)	(2.55)	(4.58)	(4.17)	(4.05)	(2.44)
Net Employment	-0.18***	-0.46***	-0.16***	-0.50***	-0.34*	-0.19	-0.51***	-0.51***
	(4.63)	(7.36)	(3.81)	(6.71)	(1.85)	(1.02)	(3.02)	(3.44)
Total Govt. Exp.	0.02	0.04	0.04	0.13*	-0.35*	-0.39**	-0.06	-0.08
	(0.44)	(0.54)	(0.95)	(1.64)	(1.77)	(1.98)	(0.33)	(0.48)
Educ. Govt. Exp.	0.00	0.01	0.005	0.03	-0.02	0.01	-0.13	-0.09
	(0.01)	(0.19)	(0.12)	(0.47)	(0.12)	(0.04)	(0.81)	(0.67)
Police Govt. Exp.	-0.01	-0.02	-0.01	-0.11	0.09	0.78	-0.01	-0.11
	(0.05)	(0.08)	(0.05)	(0.31)	(0.10)	(0.86)	(0.01)	(0.15)
Health Govt. Exp.	-0.28	-1.08	0.35	0.86	-2.48	-3.02	-8.06	-7.24
	(0.14)	(0.36)	(0.17)	(0.24)	(0.27)	(0.33)	(0.98)	(1.00)
Property Crime Rate	0.12	-2.38	0.18	-0.39	1.94	-3.08	-2.35	-4.49
	(0.02)	(0.42)	(0.02)	(0.04)	(0.16)	(0.30)	(0.16)	(0.43)
Violent Crime Rate	-2.50	-4.60	-0.57	-1.28	-0.17	-1.22	-10.90	-12.67
	(0.27)	(0.54)	(0.04)	(0.10)	(0.01)	(0.08)	(0.51)	(0.81)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county.

Table 2B.3. OLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators, Full Specification

	Dependent Variables									
	Income	Wage	Employ-ment	Net Employ-ment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
Intercept	0.08***	0.099*	-0.018*	-0.020*	0.03**	0.09***	0.26***	0.00**	0.16	-1.34
	(4.85)	(1.85)	(1.73)	(1.94)	(2.34)	(9.52)	(5.01)	(2.31)	(0.21)	(1.16)
High School$_{90}$	-0.06***	-0.15**	0.03**	0.03**	0.03**	-0.06***	-0.26***	0.99	0.18	1.69
	(3.25)	(2.28)	(2.29)	(2.53)	(2.29)	(4.93)	(4.03)	(1.52)	(0.18)	(1.18)
College$_{90}$	0.03	-0.04	0.11***	0.11***	0.05***	0.02	0.30***	1.90***	-0.65	0.49
	(1.32)	(0.50)	(7.49)	(7.78)	(3.05)	(1.51)	(4.20)	(2.72)	(0.68)	(0.35)
Poverty Rate$_{90}$	-0.025*	0.03	0.01	0.01	-0.10***	-0.10***	-0.20***	-1.15**	0.62	2.268*
	(1.75)	(0.61)	(1.03)	(0.96)	(9.21)	(10.58)	(3.85)	(2.25)	(0.77)	(1.89)
Employment$_{90}$ (0,000s)	0.00	0.00	-0.01***	-0.01***	0.00	0.00	-0.06***	-0.07	0.17	0.17
	(0.22)	(0.18)	(3.09)	(3.13)	(0.90)	(1.20)	(4.21)	(0.51)	(0.86)	(0.60)
Wage$_{90}$ (0,000s)	-0.01***	0.00	0.00***	0.00***	0.00***	-0.01***	0.00	0.13***	-0.03	-0.03
	(7.41)	(1.10)	(2.89)	(3.35)	(3.25)	(8.91)	(0.47)	(3.77)	(0.57)	(0.36)
Population$_{90}$ (0,000s)	0.00	0.00	0.01***	0.01***	0.02***	0.02***	0.06***	-0.02	-0.09	-0.22
	(0.16)	(0.22)	(2.71)	(2.70)	(8.99)	(7.53)	(5.74)	(0.16)	(0.68)	(1.12)
Total Govt Exp$_{90}$ (0,000s)	0.00	0.00	0.00	0.00	-0.01***	0.00***	-0.02***	-0.11***	0.00	0.01
	(0.99)	(0.31)	(0.26)	(0.23)	(13.16)	(7.76)	(8.17)	(4.07)	(0.10)	(0.20)
Income$_{90}$ (0,000s)	0.00	0.00	0.00	0.00	0.00***	0.00***	0.00	0.010*	0.00	0.01
	(0.19)	(0.29)	(0.60)	(0.55)	(4.88)	(4.89)	(0.09)	(1.75)	(0.10)	(0.54)
Property Crime Rate$_{90}$									0.00	0.00
									(0.87)	(0.50)
Violent Crime Rate$_{90}$									0.02	0.03
									(0.91)	(1.11)
Amenity Index	0.00	0.00	0.00***	0.00***	0.00***	0.00***	0.00	0.06***	-0.02	-0.04
	(0.74)	(1.52)	(3.04)	(3.29)	(13.84)	(11.23)	(0.61)	(4.43)	(0.97)	(1.41)
Interstate	0.00	0.00	0.00	0.00	-0.01***	0.00**	-0.02***	0.00	-0.02	-0.03
	(0.87)	(0.81)	(0.30)	(0.42)	(4.67)	(2.28)	(3.37)	(0.08)	(0.31)	(0.28)
ΔIndustry Status	0.00	0.00	0.00	0.00	0.00**	0.00	0.00	-0.03	-0.01	-0.03
	(0.07)	(0.22)	(0.89)	(0.52)	(2.02)	(1.20)	(0.85)	(1.07)	(0.35)	(0.57)
ΔPopulation	0.66***	0.06	0.66***	0.65***	0.49***	0.50***	1.84***	1.21	-0.03	1.82
	(13.71)	(0.39)	(20.44)	(20.03)	(14.23)	(16.74)	(11.58)	(0.76)	(0.01)	(0.56)

Table 2B.3. (continued)

	Income	Wage	Employ-ment	Net Employ-ment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
ΔHigh School	-0.17	-0.92	0.22**	0.28**	0.33***	-0.14	0.80	52.11***	-7.10	5.23
	(1.03)	(1.61)	(2.00)	(2.52)	(2.73)	(1.32)	(1.46)	(9.49)	(0.85)	(0.42)
ΔCollege	0.06	0.35**	0.13***	0.15***	0.14***	0.12***	0.70***	1.29	-1.75	7.88***
	(1.55)	(2.45)	(4.75)	(5.25)	(4.73)	(4.63)	(5.11)	(0.94)	(0.92)	(2.80)
ΔIndustry Emp Share	-0.21***	-0.342*	0.13***	-0.18***	0.02	0.00	-0.01	-0.28	0.12	-2.49
	(3.49)	(1.68)	(3.23)	(4.63)	(0.44)	(0.01)	(0.05)	(0.14)	(0.02)	(0.27)
R-squared	0.049	0.003	0.088	0.088	0.118	0.142	0.048	0.021	0.001	0.005

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level.

Table 2B.4. OLS Estimates of the Impact of the Meat Packing/Processing Industry on Growth in Selected Indicators, 1990-2000, No Controls

	Continuous		Gained		Lost		Both	
	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	0.08	-0.60***	0.15	-0.17	0.45	0.40	-0.25***	-0.72***
	(0.56)	(5.14)	(0.38)	(0.36)	(1.18)	(0.92)	(3.58)	(3.91)
Wage	-0.31	-1.31***	-0.71	-1.22	0.17	0.17	-0.32	-0.96
	(0.66	(3.34)	(0.51)	(0.75)	(0.13)	(0.12)	(1.40)	(1.54)
Employment	0.51***	0.35***	0.99***	1.09***	0.49*	0.39	0.03	0.11
	(5.42)	(4.37)	(3.47)	(3.31)	(1.87)	(1.30)	(0.73)	(0.84)
Net Employment	-0.77***	-0.59***	-0.34	-0.40	-0.60**	-0.75**	0.02	0.03
	(8.21)	(7.26)	(1.20)	(1.22)	(2.29)	(2.54)	(0.41)	(0.27)
Total Govt Exp	0.06	0.05	-0.20	-0.09	0.07	0.04	0.03	0.05
	(0.54)	(0.57)	(0.65)	(0.26)	(0.25)	(0.12)	(0.54)	(0.36)
Educ Govt Exp	0.06	0.07	-0.46*	-0.50	0.11	0.10	0.03	0.06
	(0.71)	(0.87)	(1.71)	(1.59)	(0.43)	(0.37)	(0.67)	(0.46)
Police Govt Exp	0.01	0.06	-1.02	-1.11	0.14	0.11	0.12	0.27
	(0.02)	(0.15)	(0.75)	(0.70)	(0.11)	(0.08)	(0.53)	(0.44)
Health Govt Exp	-2.70	-2.64	-6.91	-8.17	-0.03	1.13	0.26	0.51
	(0.61)	(0.70)	(0.52)	(0.53)	(0.00)	(0.08)	(0.12)	(0.09)
Property Crime Rate	-0.15	-2.41	-5.36	-4.99	5.02	4.53	2.19	3.05
	(0.02)	(0.40)	(0.17)	(0.17)	(0.29)	(0.18)	(0.07)	(0.07)
Violent Crime Rate	-3.02	-4.47	-14.49	-12.93	0.94	-7.75	0.59	-1.59
	(0.29)	(0.50)	(0.31)	(0.29)	(0.02)	(0.20)	(0.02)	(0.03)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.5. OLS Estimates of the Impact of the Meat Packing/Processing Industry on Growth in Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	0.01	-0.64***	0.48	0.14	0.29	0.21	-0.30***	-0.87***
	(0.10)	(5.66)	(1.19)	(0.31)	(0.77)	(0.48)	(4.49)	(4.79)
Wage	-0.31	-1.32***	-0.63	-1.14	0.18	0.16	-0.37	-1.09*
	(0.67)	(3.36)	(0.45)	(0.70)	(0.13)	(0.11)	(1.60)	(1.72)
Employment	0.46***	0.32***	1.26***	1.35***	0.32	0.20	0.01	0.03
	(5.12)	(4.24)	(4.61)	(4.27)	(1.25)	(0.68)	(0.11)	(0.23)
Net Employment	-0.82***	-0.60***	-0.07	-0.14	-0.77***	-0.94***	-0.01	-0.04
	(9.09)	(7.89)	(0.27)	(0.45)	(3.03)	(3.26)	(0.22)	(0.36)
Total Govt Exp	0.04	0.04	0.06	0.19	-0.08	-0.15	0.01	0.01
	(0.37)	(0.52)	(0.22)	(0.56)	(0.30)	(0.49)	(0.28)	(0.11)
Educ Govt Exp	0.02	0.04	-0.11	-0.15	0.00	-0.04	0.00	-0.02
	(0.29)	(0.56)	(0.44)	(0.53)	(0.01)	(0.17)	(0.02)	(0.15)
Police Govt Exp	-0.06	0.04	-0.55	-0.74	-0.35	-0.48	0.01	-0.03
	(0.13)	(0.10)	(0.41)	(0.48)	(0.28)	(0.34)	(0.05)	(0.04)
Health Govt Exp	-0.67	-0.88	-11.73	-13.48	-2.55	-1.74	0.17	0.22
	(0.15)	(0.24)	(0.89)	(0.88)	(0.21)	(0.12)	(0.08)	(0.04)
Property Crime Rate	-0.43	-2.74	-3.66	-4.10	4.09	3.64	1.07	1.37
	(0.06)	(0.45)	(0.12)	(0.14)	(0.23)	(0.14)	(0.23)	(0.03)
Violent Crime Rate	-1.93	-3.86	-9.33	-10.43	-2.81	-12.02	-3.26	-7.24
	(0.18)	(0.43)	(0.20)	(0.24)	(0.07)	(0.31)	(0.07)	(0.12)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.6. OLS Estimates of the Impact of the Meat Packing Industry on Growth of Selected Indicators, 1990-2000, No Controls

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.03	-0.46***	0.92	0.32	-0.29	-0.52	-0.25***	-0.72***
	(0.19)	(3.20)	(1.56)	(0.67)	(0.34)	(0.61)	(3.59)	(3.87)
Wage	-0.39	-0.94*	0.75	0.02	-1.47	-1.78	-0.32	-0.95
	(0.70)	(1.92)	(0.38)	(0.01)	(0.52)	(0.61)	(1.40)	(1.50)
Employment	0.32***	0.23**	1.16***	0.90***	0.85	0.89	0.03	0.10
	(2.83)	(2.37)	(2.85)	(2.75)	(1.49)	(1.50)	(0.70)	(0.80)
Net Employment	-0.98***	-0.79***	-0.03	0.06	-0.20	-0.09	0.02	0.05
	(8.58)	(7.92)	(0.08)	(0.17)	(0.34)	(0.15)	(0.47)	(0.43)
Total Govt Exp	0.14	0.13	1.06**	0.73*	0.47	0.67	0.03	0.08
	(1.12)	(1.23)	(2.41)	(2.03)	(0.76)	(1.04)	(0.64)	(0.59)
Educ Govt Exp	0.11	0.10	-0.02	-0.08	0.46	0.66	0.04	0.09
	(1.03)	(1.04)	(0.06)	(0.26)	(0.84)	(1.18)	(0.79)	(0.72)
Police Govt Exp	-0.13	-0.19	0.17	0.01	-0.04	-0.12	0.12	0.28
	(0.25)	(0.40)	(0.09)	(0.00)	(0.02)	(0.04)	(0.53)	(0.45)
Health Govt Exp	-1.69	-1.69	-5.80	-3.77	11.10	12.24	0.23	0.40
	(0.32)	(0.36)	(0.31)	(0.25)	(0.42)	(0.44)	(0.11)	(0.07)
Property Crime Rate	0.36	0.53	-5.81	-4.79	2.10	-0.88	2.36	1.72
	(0.03)	(0.05)	(0.16)	(0.16)	(0.07)	(0.03)	(0.05)	(0.03)
Violent Crime Rate	0.61	0.49	-19.63	-14.68	-9.39	-14.16	-0.36	-2.99
	(0.04)	(0.03)	(0.36)	(0.34)	(0.22)	(0.33)	(0.01)	(0.03)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat packing jobs in the county; wage share is the change in the proportion of meat packing's wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.7 OLS Estimates of the Impact of the Meat Packing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.10	-0.52***	0.60	0.17	-0.61	-0.79	-0.30***	-0.86***
	(0.64)	(3.66)	(1.02)	(0.36)	(0.74)	(0.93)	(4.44)	(4.69)
Wage	-0.42	-0.96**	0.43	-0.21	-1.61	-1.86	-0.36	-1.04
	(0.74)	(1.97)	(0.21)	(0.13)	(0.56)	(0.63)	(1.56)	(1.64)
Employment	0.27**	0.20**	1.06***	0.92***	0.49	0.53	0.01	0.03
	(2.46)	(2.15)	(2.70)	(2.89)	(0.87)	(0.92)	(0.14)	(0.26)
Net Employment	-1.03***	-0.81***	-0.12	-0.07	-0.56	-0.44	-0.005	-0.02
	(9.44)	(8.57)	(0.32)	(0.23)	(1.00)	(0.77)	(0.11)	(0.14)
Total Govt Exp	0.10	0.12	0.90**	0.65*	0.03	0.23	0.02	0.05
	(0.82)	(1.14)	(2.14)	(1.92)	(0.04)	(0.37)	(0.40)	(0.34)
Educ Govt Exp	0.04	0.05	-0.06	-0.04	0.15	0.36	0.00	0.00
	(0.44)	(0.63)	(0.17)	(0.14)	(0.28)	(0.69)	(0.26)	(0.04)
Police Govt Exp	-0.24	-0.21	0.61	0.53	-1.18	-1.28	0.03	0.03
	(0.45)	(0.45)	(0.32)	(0.34)	(0.43)	(0.46)	(0.11)	(0.04)
Health Govt Exp	1.05	1.05	1.63	0.71	2.16	3.27	0.07	-0.05
	(0.20)	(0.23	(0.09)	(0.05)	(0.08)	(0.12)	(0.03)	(0.01)
Property Crime Rate	-0.11	0.00	-3.97	-3.40	-0.33	-2.00	1.12	0.16
	(0.01)	(<0.01)	(0.10)	(0.11)	(0.01)	(0.07)	(0.02)	(<0.01)
Violent Crime Rate	3.00	2.24	-19.07	-14.28	-4.64	-17.49	-15.09	-7.90
	(0.19)	(0.15)	(0.33)	(0.32)	(0.07)	(0.40)	(0.34)	(0.08)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat packing jobs in the county; wage share is the change in the proportion of meat packing's wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.8. OLS Estimates of the Impact of the Meat Processing Industry on Growth of Selected Indicators, 1990-2000, No Controls

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.38	-1.69***	0.09	0.13	0.90*	0.65	5.79	5.61
	(0.81)	(5.43)	(0.23)	(0.27)	(1.80)	(1.38)	(1.01)	(0.80)
Wage	-0.95	-2.93***	-0.80	-0.93	1.09	0.65	6.52	4.75
	(0.60)	(2.79)	(0.61)	(0.59)	(0.65)	(0.41)	(0.34)	(0.20)
Employment	0.39	0.003	0.97***	1.19***	0.29	0.19	-2.68	-2.16
	(1.20)	(0.02)	(3.59)	(3.72)	(0.85)	(0.60)	(0.68)	(0.45)
Net Employment	-0.74**	-0.52**	-0.33	-0.33	-0.80***	-0.83***	-3.70	-3.37
	(2.30)	(2.42)	(1.24)	(1.03)	(2.35)	(2.57)	(0.94)	(0.70)
Total Govt Exp	0.03	-0.04	-0.48*	-0.57	-0.02	-0.02	-8.11*	-9.02*
	(0.09)	(0.16)	(1.66)	(1.64)	(0.06)	(0.05)	(1.90)	(1.72)
Educ Govt Exp	-0.33	-0.11	-0.49*	-0.57*	0.17	0.13	-11.28***	-14.54***
	(1.08)	(0.57)	(1.94)	(1.87)	(0.54)	(0.44)	(3.04)	(3.18)
Police Govt Exp	0.24	0.01	-0.89	-0.99	0.24	0.27	-0.39	-0.18
	(0.16)	(0.01)	(0.69)	(0.64)	(0.15)	(0.17)	(0.02)	(0.01)
Health Govt Exp	3.20	1.12	-6.94	-8.26	-14.85	-17.93	-20.20	-36.76
	(0.21)	(0.11)	(0.55)	(0.55)	(0.93)	(1.19)	(0.11)	(0.16)
Property Crime Rate	-3.86	-5.14	-2.00	-4.63	9.91	7.56	-125.45	-121.14
	(0.22)	(0.44)	(0.06)	(0.13)	(0.27)	(0.22)	(0.51)	(0.43)
Violent Crime Rate	-4.25	-9.30	-10.08	-13.09	-36.15	-43.78	-72.14	-80.26
	(0.16)	(0.54)	(0.20)	(0.24)	(0.67)	(0.83)	(0.20)	(0.19)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat processing jobs in the county; wage share is the change in the proportion of meat processing's wage bill in the county. Counties are classified into five groups; continuous, the meat processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.9. OLS Estimates of the Impact of the Meat Processing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.27	-1.66***	0.40	0.44	0.80	0.55	5.32	5.30
	(0.59)	(5.44)	(1.02)	(0.95)	(1.61)	(1.18)	(0.95)	(0.77)
Wage	-0.82	-2.88***	-0.69	-0.82	1.22	0.74	6.38	4.61
	(0.52)	(2.73)	(0.52)	(0.52)	(0.72)	(0.46)	(0.33)	(0.19)
Employment	0.43	0.01	1.23***	1.47***	0.11	0.03	-2.91	-2.01
	(1.40)	(0.07)	(4.76)	(4.78)	(0.33)	(0.11)	(0.78)	(0.43)
Net Employment	-0.70**	-0.51**	-0.07	-0.05	-0.98***	-0.99***	-3.94	-3.23
	(2.26)	(2.47)	(0.27)	(0.16)	(2.96)	(3.16)	(1.05)	(0.70)
Total Govt Exp	0.19	0.01	-0.14	-0.19	-0.17	-0.14	-8.01**	-8.53*
	(0.59)	(0.04)	(0.52)	(0.57)	(0.49)	(0.43)	(2.00)	(1.73)
Educ Govt Exp	-0.17	-0.07	-0.14	-0.18	0.00	-0.02	-11.31***	-14.28***
	(0.61)	(0.37)	(0.58)	(0.64)	(<0.01)	(0.06)	(3.28)	(3.36)
Police Govt Exp	0.51	-0.02	-0.28	0.30	-0.51	-0.40	0.18	2.39
	(0.34)	(0.02)	(0.22)	(0.20)	(0.31)	(0.26)	(0.01)	(0.11)
Health Govt Exp	2.65	-0.19	-10.03	-11.12	-9.30	-13.06	4.59	8.07
	(0.18)	(0.02)	(0.80)	(0.75)	(0.58)	(0.86)	(0.03)	(0.04)
Property Crime Rate	-4.30	-5.42	-3.56	-6.31	9.46	7.01	-135.60	-136.77
	(0.24)	(0.47)	(0.10)	(0.17)	(0.26)	(0.20)	(0.26)	(0.49)
Violent Crime Rate	-4.02	-9.30	-9.87	-13.09	-41.48	-43.78	-80.01	-80.26
	(0.15)	(0.54)	(0.19)	(0.24)	(0.76)	(0.83)	(0.22)	(0.19)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat processing jobs in the county; wage share is the change in the proportion of meat processing's wage bill in the county. Counties are classified into five groups; continuous, the meat processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.10. OLS Estimates of the Impact of the Poultry Processing Industry on Growth of Selected Indicators, 1990-2000,

Indicator	Continuous Employment Share	Continuous Wage Share	Gained Employment Share	Gained Wage Share	Lost Employment Share	Lost Wage Share	Both Employment Share	Both Wage Share
Income	0.33	-0.81***	0.61	0.17	0.06	0.28	0.55	0.03
	(0.92)	(2.64)	(0.79)	(0.19)	(0.08)	(0.16)	(0.66)	(0.03)
Wage	-0.01	-2.20**	0.37	-0.19	-0.85	-1.92	0.52	-0.54
	(0.01)	(2.12)	(0.14)	(0.06)	(0.36)	(0.32)	(0.19)	(0.14)
Employment	1.04***	0.80***	0.60	0.77	0.75	1.88	0.74	0.76
	(4.22)	(3.78)	(1.12)	(1.20)	(1.56)	(1.56)	(1.28)	(0.96)
Net Employment	-0.20	-0.04	-0.47	-0.41	-0.35	-0.88	-0.34	-0.61
	(0.81)	(0.21)	(0.88)	(0.65)	(0.73)	(0.73)	(0.58)	(0.78)
Total Govt Exp	-0.19	-0.17	-1.25***	-1.70**	0.25	0.66	-0.63	-0.92
	(0.72)	(0.75)	(2.18)	(2.45)	(0.49)	(0.51)	(1.01)	(1.08)
Educ Govt Exp	-0.03	0.01	0.72	1.16*	0.10	0.32	-0.71	-0.95
	(0.14)	(0.07)	(1.43)	(1.92)	(0.22)	(0.28)	(1.29)	(1.28)
Police Govt Exp	-0.15	0.83	2.43	3.56	0.40	1.09	0.25	-0.36
	(0.13)	(0.82)	(0.96)	(1.16)	(0.17)	(0.19)	(0.09)	(0.10)
Health Govt Exp	0.64	-0.28	-15.24	-20.91	-5.71	-20.52	6.44	5.08
	(0.05)	(0.03)	(0.62)	(0.70)	(0.26)	(0.36)	(0.24)	(0.14)
Property Crime Rate	0.97	-4.37	1.20	2.27	-1.54	13.24	5.10	0.48
	(0.08)	(0.39)	(0.04)	(0.06)	(0.05)	(0.23)	(0.23)	(0.01)
Violent Crime Rate	-3.39	-2.23	-7.56	-11.44	10.74	27.58	3.63	5.51
	(0.18)	(0.13)	(0.16)	(0.19)	(0.32)	(0.33)	(0.08)	(0.08)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of poultry processing jobs in the county; wage share is the change in the proportion of poultry processing's wage bill in the county. Counties are classified into five groups; continuous, the poultry processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the poultry processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.11. OLS Estimates of the Impact of the Poultry Processing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	0.31	-0.85***	-0.13	-0.67	0.02	0.19	0.47	-0.17
	(0.88)	(2.81)	(0.16)	(0.69)	(0.03)	(0.11)	(0.57)	(0.15)
Wage	0.09	-2.14**	-0.47	-1.09	-0.79	-1.79	0.49	-0.65
	(0.07)	(2.06)	(0.16)	(0.32)	(0.34)	(0.30)	(0.17)	(0.17)
Employment	0.99***	0.76***	0.47	0.71***	0.60	1.52	0.61	0.57
	(4.18)	(3.75)	(1.00)	(1.08)	(1.31)	(1.31)	(1.11)	(0.75)
Net Employment	-0.25	-0.08	-0.50	-0.42	-0.49	-1.24	-0.46	-0.80
	(1.07)	(0.42)	(0.88)	(0.64)	(1.07)	(1.07)	(0.83)	(1.06)
Total Govt Exp	-0.24	-0.23	-1.64***	-2.02***	0.32	0.83	-0.66	-0.91
	(0.94)	(1.05)	(2.69)	(2.88)	(0.66)	(0.67)	(1.12)	(1.13)
Educ Govt Exp	-0.04	-0.02	0.47	0.87	0.14	0.41	-0.69	-0.95
	(0.17)	(0.12)	(0.90)	(1.45)	(0.33)	(0.39)	(1.37)	(1.36)
Police Govt Exp	-0.35	0.64	0.87	1.94	0.46	1.25	-0.30	-0.88
	(0.30)	(0.65)	(0.31)	(0.60)	(0.20)	(0.22)	(0.11)	(0.24)
Health Govt Exp	-1.32	-1.76	-8.21	-11.79	-3.94	-15.63	6.95	7.02
	(0.11)	(0.18)	(0.30)	(0.37)	(0.18)	(0.28)	(0.26)	(0.19)
Property Crime Rate	1.22	-4.31	2.68	3.34	-2.71	10.16	3.94	-1.35
	(0.09)	(0.38)	(0.08)	(0.08)	(0.09)	(0.17)	(0.17)	(0.03)
Violent Crime Rate	-3.19	-2.28	6.99	4.02	-0.02	23.87	9.13	0.13
	(0.17)	(0.14)	(0.14)	(0.06)	(<0.01)	(0.27)	(0.26)	(<0.01)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of poultry processing jobs in the county; wage share is the change in the proportion of poultry processing's wage bill in the county. Counties are classified into five groups; continuous, the poultry processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the poultry processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.12. Predicted Share of MPP Employment in 1990 (First stage of WLS estimation)

	All	Packing	Processing	Poultry
Dependent Variable	% MPP Employment	% MPP Employment	% MPP Employment	% MPP Employment
Intercept	4.00**	1.38	0.61	2.01*
	(2.14)	(1.15)	(0.75)	(1.68)
$Pastureshare_{87}$	0.19	0.26	-0.11	0.04
	(0.32)	(0.66)	(0.41)	(0.11)
$Cornshare_{87}$	0.00	0.00	0.00	0.00
	(0.09)	(0.25)	(1.56)	(0.94)
$Beansshare_{87}$	0.01*	0.01*	0.004*	0.00
	(1.93)	(1.79)	(1.92)	(0.08)
$Cowsshare_{87}$	0.01***	0.01***	0.00	0.00
	(6.33)	(9.15)	(1.04)	(<0.01)
$Pigsshare_{87}$	0.00	0.00	0.00	0.00
	(0.53)	(1.58)	(0.72)	(1.24)
$Chickensshare_{87}$	0.01***	0.00	0.00	0.01***
	(10.97)	(0.60)	(0.30)	(17.50)
$HighSchool_{90}$	-1.93	-1.02	0.28	-1.18
	(0.75)	(0.62)	(0.25)	(0.72)
$College_{90}$	-8.62***	-3.27*	-1.16	-4.19**
	(3.20)	(1.89)	(1.00)	(2.42)
$PovertyRate_{90}$	-3.51	-0.41	-0.34	-2.76*
	(1.54)	(0.28)	(0.35)	(1.89)
$Employment_{90}$	0.23***	0.07*	0.04	0.12***
	(3.45)	(1.70)	(1.33)	(2.78)
$AverageWage_{90}$	-0.04***	-0.03**	-0.01*	-0.01
	(2.65)	(2.45)	(1.82)	(0.45)
$Population_{90}$	-0.04	-0.05	-0.01	0.02
	(0.76)	(1.44)	(0.57)	(0.65)
$GovtExp_{90}$	0.03***	0.03***	0.00	0.01
	(2.77)	(3.63)	(0.15)	(0.78)
$Income_{90}$	-0.01***	0.00	0.00	-0.004**
	(2.25)	(0.71)	(0.33)	(2.56)
Amenities	0.10	0.07	-0.01	0.05
	(1.61)	(1.57)	(0.44)	(1.23)
Interstate	-0.19	-0.04	0.03	-0.19
	(0.80)	(0.24)	(0.30)	(1.21)
R-square	0.2131	0.1399	0.0214	0.3136
n	858	858	858	858

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level.

Table 2B.13. Predicted Share of MPP Wage Bill in 1990 (First stage of WLS estimation)

	All	Packing	Processing	Poultry
Dependent Variable	**% MPP Wagebill**	**% MPP Wagebill**	**% MPP Wagebill**	**% MPP Wagebill**
Intercept	3.30*	1.01	0.39	1.90*
	(1.67)	(0.80)	(0.38)	(1.68)
$Pastureshare_{87}$	0.13	0.24	-0.11	0.01
	(0.21)	(0.58)	(0.34)	(0.02)
$Cornshare_{87}$	0.00	0.00	-0.004*	0.00
	(0.19)	(0.39)	(1.84)	(0.88)
$Beansshare_{87}$	0.01*	0.01*	0.004*	0.00
	(1.83)	(1.67)	(1.73)	(0.23)
$Cowsshare_{87}$	0.01***	0.01***	0.00	0.00
	(5.33)	(7.71)	(0.81)	(0.06)
$Pigsshare_{87}$	0.00	0.004*	0.00	-0.00
	(0.88)	(1.92)	(0.59)	(1.14)
$Chickensshare_{87}$	0.01***	0.00	0.00	0.01***
	(8.53)	(0.50)	(0.18)	(15.34)
$HighSchool_{90}$	-0.65	-0.49	0.89	-1.05
	(0.24)	(0.28)	(0.64)	(0.67)
$College_{90}$	-8.00***	-2.95	-1.21	-3.84**
	(2.80)	(1.61)	(0.82)	(2.35)
$PovertyRate_{90}$	-3.13	-0.30	-0.22	-2.62*
	(1.29)	(0.19)	(0.17)	(1.89)
$Employment_{90}$	0.21***	0.08*	0.03	0.10**
	(2.99)	(1.66)	(0.87)	(2.57)
$AverageWage_{90}$	-0.05***	-0.02**	-0.02*	-0.01
	(2.72)	(2.22)	(1.88)	(0.56)
$Population_{90}$	-0.03	-0.03	-0.02	0.02
	(0.65)	(1.01)	(0.75)	(0.67)
$GovtExp_{90}$	0.03**	0.02***	0.00	0.00
	(2.47)	(3.23)	(0.16)	(0.54)
$Income_{90}$	-0.01*	0.00	0.00	-0.004**
	(1.96)	(0.97)	(0.05)	(2.38)
Amenities	0.08	0.07	-0.03	0.04
	(1.15)	(1.55)	(0.91)	(1.09)
Interstate	-0.19	-0.07	0.07	-0.19
	(0.74)	(0.44)	(0.54)	(1.28)
R-square	0.155	0.116	0.188	0.264
n	858	858	858	858

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level.

Table 2B.14. WLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators, No Controls

	All Industries		Packing		Poultry		Processing	
Dependent Variable	**Employment Share (1)**	**Wage Share (2)**	**Employment Share (3)**	**Wage Share (4)**	**Employment Share (5)**	**Wage Share (6)**	**Employment Share (7)**	**Wage Share (8)**
Income	-0.21***	-0.60***	-0.23***	-0.60***	0.50	-0.06	0.14	-0.12
	(4.28)	(5.94)	(4.40)	(4.99)	(0.77)	(0.08)	(0.47)	(0.36)
Wage	-0.33*	-1.07***	-0.32*	-0.90**	0.43	-0.67	-0.73	-1.21
	(1.81)	(2.88)	(1.66)	(2.04)	(0.20)	(0.27)	(0.66)	(0.97)
Employment	0.09**	0.28**	0.05	0.19**	0.67	0.74	0.94***	0.99***
	(2.36)	(3.52)	(1.30)	(2.04)	(1.61)	(1.54)	(3.95)	(3.69)
Net Employment	-0.04	-0.25***	-0.02	-0.17*	-0.43	-0.41	-0.38	-0.41
	(1.17)	(3.21)	(0.44)	(1.89)	(1.03)	(0.86)	(1.59)	(1.51)
Total Govt. Exp.	0.03	0.04	0.05	0.14	-1.09***	-1.25***	-0.43*	-0.43*
	(0.77)	(0.58)	(1.21)	(1.60)	(2.59)	(2.58)	(1.86)	(1.68)
Educ. Govt. Exp.	0.02	0.04	0.04	0.09	-0.24	-0.12	-0.44**	-0.43*
	(0.90)	(0.69)	(1.25)	(1.27)	(0.62)	(0.27)	(2.14)	(1.88)
Police Govt. Exp.	0.09	0.10	0.12	0.15	0.75	1.32	-0.93	-0.92
	(0.61)	(0.35)	(0.61)	(0.32)	(0.56)	(0.85)	(0.92)	(0.81)
Health Govt. Exp.	-0.05	-1.07	0.18	-0.14	-2.96	-5.04	-5.77	-6.35
	(0.05)	(0.44)	(0.13)	(0.04)	(0.16)	(0.23)	(0.73)	(0.71)
Property Crime Rate	0.31	-2.05	-0.002	-0.32	2.74	1.62	-0.46	-3.91
	(0.05)	(0.36)	(<0.01)	(0.04)	(0.10)	(0.05)	(0.04)	(0.36)
Violent Crime Rate	-3.15	-5.07	-2.79	-3.37	-0.33	-2.19	-10.57	-11.58
	(0.31)	(0.54)	(0.18)	(0.23)	(0.01)	(0.05)	(0.47)	(0.62)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county.

Table 2B.15. WLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators

	All Industries		Packing		Poultry		Processing	
Dependent Variable	Employment Share (1)	Wage Share (2)	Employment Share (3)	Wage Share (4)	Employment Share (5)	Wage Share (6)	Employment Share (7)	Wage Share (8)
Income	-0.26***	-0.68***	-0.29***	-0.71***	0.30	-0.28	0.44	0.16
	(5.35)	(6.81)	(5.53)	(6.03)	(0.47)	(0.38)	(1.49)	(0.47)
Wage	-0.37**	-1.13***	-0.35*	-0.96***	0.31	-0.79	-0.51	-1.00
	(2.01)	(3.00)	(1.81)	(2.16)	(0.14)	(0.32)	(0.46)	(0.88)
Employment	0.07*	0.25**	0.02	0.14	0.59	0.66	1.20***	1.23***
	(1.89)	(3.31)	(0.62)	(1.52)	(1.47)	(1.43)	(5.22)	(4.78)
Net Employment	-0.07*	-0.28***	-0.05	-0.23***	-0.51	-0.49	-0.13	-0.16
	(1.81)	(3.70)	(1.23)	(2.58)	(1.28)	(1.07)	(0.56)	(0.63)
Total Govt. Exp.	0.02	0.04	0.04	0.12	-1.04***	-1.18***	-0.08	-0.10
	(0.55)	(0.56)	(0.96)	(1.44)	(2.61)	(2.58)	(0.39)	(0.47)
Educ. Govt. Exp.	0.00	0.01	0.003	0.02	-0.34	-0.22	-0.10	-0.10
	(0.05)	(0.10)	(0.12)	(0.31)	(0.94)	(0.51)	(0.51)	(0.49)
Police Govt. Exp.	0.02	0.03	0.02	-0.01	0.62	1.19	-0.24	-0.28
	(0.12)	(0.10)	(0.10)	(0.01)	(0.47)	(0.78)	(0.25)	(0.25)
Health Govt. Exp.	-0.18	-1.11	0.41	0.72	-1.63	-3.62	-8.22	-8.76
	(0.15)	(0.45)	(0.29)	(0.23)	(0.09)	(0.17)	(1.05)	(0.99)
Property Crime Rate	0.10	-2.32	-0.85	-1.00	2.39	0.99	0.17	-3.17
	(0.02)	(0.41)	(0.09)	(0.11)	(0.09)	(0.03)	(0.01)	(0.29)
Violent Crime Rate	-2.11	-4.12	-1.25	-1.98	0.61	-1.69	-5.77	-9.02
	(0.21)	(0.44)	(0.08)	(0.13)	(0.02)	(0.04)	(0.25)	(0.48)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county.

Table 2B.16 WLS Estimates of the Impact of Growth in the Meat Packing/Processing Industry on Growth in Selected Indicators, Full Specification

	Dependent Variables									
	Income	Wage	Employ-ment	Net Employment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
Intercept	0.09***	0.06	-0.03**	-0.03***	0.02**	0.09***	0.094*	0.00	0.03	-2.13**
	(5.56)	(0.94)	(2.54)	(2.68)	(2.00)	(9.26)	(1.93)	(0.41)	(0.04)	(1.97)
High School$_{90}$	-0.09***	-0.12	0.05***	0.06***	0.04***	-0.05***	-0.04	-0.51	0.28	2.14
	(4.10)	(1.44)	(3.17)	(3.38)	(2.88)	(4.13)	(0.66)	(0.95)	(0.34)	(1.59)
College$_{90}$	0.03	0.01	0.14***	0.14***	0.07***	-0.03**	0.84***	1.098*	-0.45	1.59
	(1.40)	(0.12)	(7.88)	(8.03)	(4.46)	(2.51)	(12.97)	(1.95)	(0.59)	(1.28)
Poverty Rate$_{90}$	-0.02	0.05	0.02	0.02	-0.12***	-0.10***	-0.12***	-1.37***	0.59	2.55**
	(1.58)	(1.05)	(1.48)	(1.52)	(11.53)	(12.00)	(2.69)	(3.66)	(0.90)	(2.41)
Employment$_{90}$ (0,000s)	-0.01	0.00	-0.02***	-0.02***	-0.01**	0.00	-0.14***	-0.01	0.21	0.24
	(1.10)	(0.23)	(3.96)	(3.99)	(2.25)	(1.36)	(8.97)	(0.88)	(1.23)	(0.87)
Wage$_{90}$ (0,000s)	-0.01***	0.00	0.00***	0.00***	0.00***	0.00***	-0.01***	0.06**	-0.01	0.01
	(7.95)	(0.88)	(3.02)	(3.48)	(3.66)	(7.71)	(4.34)	(2.22)	(0.20)	(0.14)
Population$_{90}$ (0,000s)	0.00	0.00	0.01***	0.01***	0.03***	0.02***	0.11***	-0.03	-0.08	-0.26
	(0.30)	(0.15)	(2.86)	(2.83)	(9.79)	(8.81)	(10.14)	(0.34)	(0.65)	(1.33)
Total Govt Exp$_{90}$ (0,000s)	0.00	0.00	0.00	0.00	-0.01***	0.00***	-0.03***	-0.10***	0.00	0.02
	(1.04)	(0.09)	(0.07)	(0.02)	(11.97)	(6.57)	(10.18)	(3.88)	(0.08)	(0.46)
Income$_{90}$ (0,000s)	0.00	0.00	0.00	0.00	0.00***	0.00***	0.00	0.01**	0.00	0.01
	(0.67)	(0.28)	(0.07)	(0.01)	(3.55)	(5.89)	(0.30)	(2.04)	(0.14)	(0.48)
Property Crime Rate$_{90}$									0.00	0.00
									(0.87)	(0.50)
Violent Crime Rate$_{90}$									0.02	0.03
									(0.91)	(1.11)
Amenity Index	0.00	0.00	0.00***	0.00***	0.00***	0.00***	0.00	0.42***	-0.01	-0.04
	(0.83)	(1.34)	(4.67)	(4.88)	(16.24)	(10.03)	(0.71)	(3.94)	(0.75)	(1.57)
Interstate	0.00	0.01	0.00	0.00	-0.01***	0.00	-0.02***	-0.04	0.00	0.02
	(0.49)	(0.73)	(0.70)	(0.59)	(4.83)	(0.07)	(4.46)	(0.88)	(0.05)	(0.17)
ΔIndustry Status	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.01	-0.03
	(1.04)	(0.64)	(0.58)	(0.17)	(0.97)	(0.63)	(1.05)	(0.82)	(0.36)	(0.63)

Table 2B.16 (continued)

	Income	Wage	Employment	Net Employment	Total Govt. Exp.	Educ. Govt. Exp.	Police Govt Exp.	Health Govt. Exp.	Property Crime Rate	Violent Crime Rate
ΔPopulation	0.62***	0.09	0.58***	0.57***	0.44***	0.42***	1.17***	0.34	-0.02	3.17
	(12.64)	(0.47)	(15.44)	(15.26)	(13.22)	(16.04)	(8.39)	(0.28)	(0.01)	(1.16)
ΔHigh School	-0.307*	-0.86	0.35**	0.39***	0.42***	-0.13	0.916*	33.60***	-6.14	13.36
	(1.65)	(1.22)	(2.46)	(2.72)	(3.29)	(1.32)	(1.72)	(7.21)	(0.85)	(1.14)
ΔCollege	0.03	0.59***	0.11***	0.12***	0.11***	0.08***	0.44***	1.882*	-1.69	12.28***
	(0.80)	(3.67)	(3.38)	(3.69)	(3.99)	(3.55)	(3.66)	(1.77)	(1.12)	(5.00)
ΔIndustry Emp Share	-0.26***	-0.37**	0.071*	-0.067*	0.02	0.00	0.02	-0.18	0.10	-2.11
	(5.35)	(2.01)	(1.89)	(1.81)	(0.55)	(0.05)	(0.12)	(0.15)	(0.02)	(0.21)
R-squared	0.051	0.004	0.071	0.072	0.137	0.131	0.083	0.016	0.002	0.017

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level

Table 2B.17. WLS Estimates of the Impact of the Meat Packing/Processing Industry on Change in Selected Indicators, 1990-2000, No Controls

	Continuous		Gained		Lost		Both	
	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Income	0.08	-0.59***	0.16	-0.03	0.43	0.38	-0.25***	-0.74***
	(0.43)	(3.68)	(0.33)	(0.09)	(0.82)	(0.64)	(4.79)	(5.20)
Wage	-0.31	-1.31***	-0.79	-1.13	0.17	0.17	-0.33*	-0.96*
	(0.44)	(2.20)	(0.64)	(0.77)	(0.09)	(0.08)	(1.69)	(1.83)
Employment	0.51***	0.35***	1.04***	1.20***	0.50	0.40	0.03	0.10
	(3.45)	(2.77)	(4.05)	(3.94)	(1.22)	(0.85)	(0.79)	(0.88)
Net Employment	-0.78***	-0.58***	-0.32	-0.38	-0.60	-0.75*	0.02	0.05
	(5.27)	(4.68)	(1.25)	(1.26)	(1.44)	(1.61)	(0.54)	(0.45)
Total Govt Exp	0.05	0.05	-0.30	-0.24	0.07	0.04	0.03	0.07
	(0.41)	(0.43)	(1.29)	(0.87)	(0.20)	(0.10)	(0.88)	(0.72)
Educ Govt Exp	0.07	0.08	-0.41**	-0.44**	0.08	0.08	0.03	0.07
	(0.69)	(0.86)	(2.21)	(2.01)	(0.27)	(0.23)	(1.08)	(0.88)
Police Govt Exp	0.03	0.08	-1.02	-1.12	0.09	0.07	0.12	0.28
	(0.05)	(0.17)	(1.06)	(0.99)	(0.06)	(0.04)	(0.79)	(0.69)
Health Govt Exp	-2.57	-2.48	-5.56	-6.48	-0.40	0.76	0.27	0.62
	(0.56)	(0.64)	(0.70)	(0.68)	(0.03)	(0.05)	(0.22)	(0.18)
Property Crime Rate	-0.12	-2.37	-5.00	-4.04	1.58	4.39	4.93	2.24
	(0.02)	(0.39)	(0.20)	(0.17)	(0.05)	(0.17)	(0.28)	(0.05)
Violent Crime Rate	-3.09	-4.55	-14.46	-11.92	0.39	-7.46	0.76	-1.49
	(0.26)	(0.46)	(0.35)	(0.31)	(0.01)	(0.18)	(0.03)	(0.02)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both , the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.18. WLS Estimates of the Impact of the Meat Packing/Processing Industry on Change in Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Dependent Variable	Employment Share (1)	Wage Share (2)	Employment Share (3)	Wage Share (4)	Employment Share (5)	Wage Share (6)	Employment Share (7)	Wage Share (8)
Income	0.01	-0.65***	0.51	0.32	0.31	0.23	-0.31***	-0.90***
	(0.05)	(4.11)	(1.57)	(0.83)	(0.60)	(0.38)	(6.03)	(6.39)
Wage	-0.30	-1.31***	-0.57	-0.90	0.16	0.16	-1.12**	-1.09*
	(0.43)	(2.19)	(0.47)	(0.62)	(0.08)	(0.07)	(2.10)	(1.72)
Employment	0.47***	0.33***	1.31***	1.48***	0.34	0.22	0.00	0.02
	(3.31)	(2.75)	(5.25)	(5.02)	(0.85)	(0.49)	(0.09)	(0.20)
Net Employment	-0.82***	-0.60***	-0.06	-0.10	-0.75*	-0.91**	-0.01	-0.03
	(5.72)	(4.95)	(0.22)	(0.36)	(1.87)	(2.02)	(0.19)	(0.26)
Total Govt Exp	0.04	0.05	-0.02	0.06	-0.06	-0.13	0.02	0.03
	(0.31)	(0.43)	(0.08)	(0.24)	(0.17)	(0.33)	(0.52)	(0.36)
Educ Govt Exp	0.04	0.05	-0.12	-0.14	0.00	-0.04	0.00	0.00
	(0.35)	(0.56)	(0.67)	(0.70)	(0.01)	(0.12)	(0.17)	(0.04)
Police Govt Exp	-0.01	0.11	-0.36	-0.47	-0.19	-0.25	0.00	-0.03
	(0.01)	(0.25)	(0.39)	(0.43)	(0.13)	(0.15)	(0.01)	(0.08)
Health Govt Exp	-1.08	-1.25	-9.09	-10.54	-1.98	-1.25	0.17	0.35
	(0.24)	(0.32)	(1.14)	(1.12)	(0.15)	(0.09)	(0.14)	(0.10)
Property Crime Rate	-0.40	-2.70	-2.82	-2.71	4.18	3.61	0.37	0.33
	(0.06)	(0.44)	(0.11)	(0.12)	(0.23)	(0.14)	(0.01)	(0.01)
Violent Crime Rate	-1.12	-3.21	-4.79	-6.39	-4.53	-14.62	-4.41	-8.36
	(0.10)	(0.32)	(0.12)	(0.17)	(0.15)	(0.34)	(0.09)	(0.12)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.19. WLS Estimates of the Impact of the Meat Packing Industry on Growth of Selected Indicators, 1990-2000, No Controls

Indicator	Continuous Employment Share	Continuous Wage Share	Gained Employment Share	Gained Wage Share	Lost Employment Share	Lost Wage Share	Both Employment Share	Both Wage Share
Income	-0.03	-0.46**	0.81	0.23	-0.31	-0.55	-0.25***	-0.72***
	(0.11)	(1.98)	(1.44)	(0.49)	(0.23)	(0.39)	(4.62)	(5.01)
Wage	-0.40	-0.94	0.56	-0.13	-1.44	-1.75	-0.32	-0.96**
	(0.40)	(1.09)	(0.27)	(0.07)	(0.29)	(0.34)	(1.63)	(1.75)
Employment	0.32	0.23	1.04**	0.83***	0.88	0.92	0.03	0.09
	(1.56)	(1.30)	(2.39)	(2.36)	(0.86)	(0.87)	(0.76)	(0.84)
Net Employment	-0.98***	-0.79***	-0.16	-0.02	-0.17	-0.06	0.02	0.06
	(4.79)	(4.44)	(0.36)	(0.04)	(0.16)	(0.06)	(0.55)	(0.50)
Total Govt Exp	0.14	0.13	1.05**	0.71**	0.49	0.69	0.04	0.08
	(0.69)	(0.75)	(2.49)	(2.08)	(0.49)	(0.67)	(0.85)	(0.75)
Educ Govt Exp	0.12	0.10	0.15	0.05	0.40	0.60	0.03	0.08
	(0.75)	(0.77)	(0.45)	(0.17)	(0.51)	(0.74)	(1.07)	(0.95)
Police Govt Exp	-0.18	-0.23	0.10	-0.03	0.32	0.26	0.13	0.31
	(0.18)	(0.27)	(0.05)	(0.02)	(0.06)	(0.05)	(0.65)	(0.57)
Health Govt Exp	-1.62	-1.61	-5.23	-3.29	10.49	11.58	0.28	0.64
	(0.23)	(0.26)	(0.35)	(0.27)	(0.30)	(0.31)	(0.20)	(0.16)
Property Crime Rate	0.50	0.67	-5.32	-4.30	1.72	-1.29	2.65	2.25
	(0.04)	(0.06)	(0.20)	(0.20)	(0.06)	(0.04)	(0.06)	(0.04)
Violent Crime Rate	0.60	0.49	-19.23	-14.49	-9.38	-14.14	1.52	-2.26
	(0.03)	(0.03)	(0.43)	(0.41)	(0.18)	(0.27)	(0.02)	(0.02)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of MPP industry jobs in the county; wage share is the change in the proportion of MPP industry wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.20. WLS Estimates of the Impact of the Meat Packing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.11	-0.52**	0.50	0.09	-0.58	-0.76	-0.30***	-0.88***
	(0.43)	(2.31)	(0.89)	(0.20)	(0.44)	(0.56)	(5.69)	(6.03)
Wage	-0.42	-0.96	0.34	-0.30	-1.64	-1.89	-0.37*	-1.07**
	(0.42)	(1.12)	(0.16)	(0.17)	(0.32)	(0.36)	(1.82)	(1.93)
Employment	0.28	0.21	1.02**	0.90***	0.50	0.53	0.01	0.03
	(1.41)	(1.25)	(2.41)	(2.61)	(0.49)	(0.51)	(0.17)	(0.27)
Net Employment	-1.02***	-0.80***	-0.17	0.05	-0.55	-0.44	0.00	-0.01
	(5.17)	(4.69)	(0.41)	(0.15)	(0.55)	(0.42)	(0.08)	(0.11)
Total Govt Exp	0.10	0.12	0.93**	0.66**	0.00	0.18	0.02	0.04
	(0.52)	(0.74)	(2.33)	(2.06)	(<0.01)	(0.19)	(0.46)	(0.36)
Educ Govt Exp	0.06	0.06	0.09	0.07	0.15	0.36	0.01	0.01
	(0.38)	(0.50)	(0.29)	(0.29)	(0.20)	(0.47)	(0.20)	(0.13)
Police Govt Exp	-0.30	-0.23	0.76	0.64	-1.28	-1.39	0.01	-0.01
	(0.31)	(0.27)	(0.36)	(0.38)	(0.26)	(0.27)	(0.05)	(0.01)
Health Govt Exp	-0.02	-0.04	0.97	0.44	5.32	6.61	0.38	0.86
	(<0.01)	(0.01)	(0.06)	(0.04)	(0.15)	(0.18)	(0.26)	(0.22)
Property Crime Rate	-0.44	-0.23	-3.68	-2.92	-2.51	-4.69	1.04	0.13
	(0.04)	(0.02)	(0.13)	(0.13)	(0.08)	(0.15)	(0.02)	(<0.01)
Violent Crime Rate	4.09	3.36	-17.32	-12.99	-19.83	-22.97	-3.25	-8.86
	(0.22)	(0.19)	(0.37)	(0.35)	(0.38)	(0.44)	(0.04)	(0.09)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat packing jobs in the county; wage share is the change in the proportion of meatpacking's wage bill in the county. Counties are classified into five groups; continuous, the meat packing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat packing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.21. WLS Estimates of the Impact of the Meat Processing Industry on Growth of Selected Indicators, 1990-2000, No Controls

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.39	-1.69**	0.13	0.15	0.88	0.63	6.75	7.55
	(0.31)	(2.04)	(0.39)	(0.37)	(0.66)	(0.51)	(0.74)	(0.65)
Wage	-0.95	-2.93	-0.84	-1.01	1.07	0.63	3.45	-0.28
	(0.21)	(0.96)	(0.70)	(0.70)	(0.22)	(0.14)	(0.10)	(0.01)
Employment	0.39	0.00	1.02***	1.30***	0.30	0.20	-2.06	-0.49
	(0.40)	(<0.01)	(4.03)	(4.19)	(0.29)	(0.21)	(0.29)	(0.05)
Net Employment	-0.74	-0.52	-0.33	-0.34	-0.79	-0.82	-3.09	-1.74
	(0.75)	(0.80)	(1.29)	(1.08)	(0.77)	(0.84)	(0.43)	(0.19)
Total Govt Exp	0.03	-0.04	-0.47*	-0.56*	-0.12	-0.01	-6.95	-6.95
	(0.04)	(0.06)	(1.94)	(1.88)	(0.02)	(0.01)	(1.01)	(0.80)
Educ Govt Exp	-0.33	-0.11	-0.47**	-0.55**	0.17	-0.13	-8.91	-9.81
	(0.40)	(0.21)	(2.17)	(2.08)	(0.19)	(0.16)	(1.45)	(1.27)
Police Govt Exp	0.24	0.01	-1.08	-1.25	0.23	0.26	-0.12	-0.03
	(0.06)	(0.01)	(1.01)	(0.96)	(0.05)	(0.06)	(<0.01)	(<0.01)
Health Govt Exp	3.15	1.14	-5.82	-6.87	-14.95	-18.02	-1.35	-8.69
	(0.10)	(0.05)	(0.69)	(0.67)	(0.44)	(0.56)	(0.01)	(0.03)
Property Crime Rate	-3.81	-4.98	-0.83	-4.18	9.00	6.66	201.24	16.67
	(0.18)	(0.37)	(0.05)	(0.21)	(0.21)	(0.16)	(0.87)	(0.06)
Violent Crime Rate	-4.18	-9.46	-11.13	-9.57	-37.42	-40.04	65.35	17.73
	(0.12)	(0.40)	(0.35)	(0.27)	(0.51)	(0.56)	(0.16)	(0.04)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat processing jobs in the county; wage share is the change in the proportion of meat processing's wage bill in the county. Counties are classified into five groups; continuous, the meat processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.22. WLS Estimates of the Impact of the Meat Processing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	-0.28	-1.66**	0.48	0.54	0.80	0.55	5.22	6.25
	(0.23)	(2.06)	(1.52)	(1.41)	(0.61)	(0.45)	(0.59)	(0.56)
Wage	-0.80	-2.86	-0.57	-0.72	1.19	0.71	3.01	-0.74
	(0.18)	(0.94)	(0.48)	(0.49)	(0.24)	(0.15)	(0.09)	(0.02)
Employment	0.42	0.01	1.33***	1.64***	0.14	0.63	-3.32	-1.42
	(0.44)	(0.02)	(5.43)	(5.51)	(0.14)	(0.06)	(0.48)	(0.16)
Net Employment	-0.72	-0.51	-0.03	0.01	-0.95	-0.96	-4.36	-2.68
	(0.77)	(0.82)	(0.11)	(0.02)	(0.95)	(1.01)	(0.63)	(0.31)
Total Govt Exp	0.18	0.00	-0.09	-0.11	-0.16	-0.13	-7.93	-7.83
	(0.20)	(0.01)	(0.38)	(0.39)	(0.17)	(0.15)	(1.24)	(0.97)
Educ Govt Exp	-0.16	-0.06	-0.08	-0.11	0.01	-0.01	-9.63*	-9.94
	(0.21)	(0.13)	(0.40)	(0.43)	(0.01)	(0.01)	(1.72)	(1.40)
Police Govt Exp	0.27	-0.14	-0.30	-0.34	-0.39	-0.29	-3.67	-3.53
	(0.07)	(0.05)	(0.29)	(0.27)	(0.09)	(0.07)	(0.13)	(0.10)
Health Govt Exp	4.11	0.73	-8.57	-9.87	-8.75	-12.56	0.30	-12.91
	(0.13)	(0.03)	(1.03)	(0.97)	(0.25)	(0.39)	(<0.01)	(0.04)
Property Crime Rate	-3.68	-5.02	1.76	-0.89	9.93	7.46	-168.03	-0.73
	(0.18)	(0.37)	(0.09)	(0.04)	(0.23)	(0.18)	(0.73)	(<0.01)
Violent Crime Rate	-3.49	-8.98	-1.41	-1.28	-39.56	-41.97	37.89	5.03
	(0.10)	(0.38)	(0.04)	(0.04)	(0.53)	(0.59)	(0.09)	(0.01)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of meat processing jobs in the county; wage share is the change in the proportion of meat processing's wage bill in the county. Counties are classified into five groups; continuous, the meat processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the meat processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.23. WLS Estimates of the Impact of the Poultry Processing Industry on Growth of Selected Indicators, 1990-2000, No Controls

Indicator	Continuous		Gained		Lost		Both	
	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	0.32	-0.82	0.58	-0.08	0.03	0.23	0.54	0.57
	(0.19)	(0.57)	(0.57)	(0.06)	(0.01)	(0.03)	(0.52)	(0.44)
Wage	-0.02	-2.20	0.62	-0.44	-0.86	-1.95	0.52	0.35
	(<0.01)	(0.47)	(0.19)	(0.11)	(0.08)	(0.07)	(0.15)	(0.08)
Employment	1.04	0.80	0.51	0.60	0.74	1.86	0.69	0.83
	(0.96)	(0.86)	(0.80)	(0.78)	(0.35)	(0.35)	(1.04)	(0.99)
Net Employment	-0.20	-0.05	-0.54	-0.56	-0.36	-0.90	-0.41	-0.53
	(0.19)	(0.05)	(0.84)	(0.73)	(0.17)	(0.17)	(0.61)	(0.63)
Total Govt Exp	-0.20	-0.17	-1.54**	-1.99**	0.23	0.60	-1.09	-1.31
	(0.19)	(0.19)	(2.36)	(2.56)	(0.11)	(0.11)	(1.62)	(1.55)
Educ Govt Exp	-0.04	0.01	0.46	0.79	0.08	0.27	-1.09*	-1.31*
	(0.04)	(0.01)	(0.75)	(1.10)	(0.04)	(0.05)	(1.74)	(1.67)
Police Govt Exp	-0.23	0.82	1.86	2.80	0.21	0.61	0.01	-0.02
	(0.07)	(0.27)	(0.89)	(1.13)	(0.03)	(0.04)	(<0.01)	(0.01)
Health Govt Exp	0.70	-0.29	-17.24	-23.26	-5.58	-20.17	11.16	13.18
	(0.01)	(0.01)	(0.60)	(0.68)	(0.06)	(0.09)	(0.38)	(0.35)
Property Crime Rate	1.04	-4.38	4.54	6.25	5.32	13.81	1.27	1.93
	(0.02)	(0.08)	(0.10)	(0.12)	(0.05)	(0.05)	(0.03)	(0.04)
Violent Crime Rate	-3.28	-2.25	-7.83	-11.71	11.09	28.49	7.17	7.25
	(0.04)	(0.03)	(0.12)	(0.15)	(0.07)	(0.07)	(0.11)	(0.09)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of poultry processing jobs in the county; wage share is the change in the proportion of poultry processing's wage bill in the county. Counties are classified into five groups; continuous, the poultry processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the poultry processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

Table 2B.24. WLS Estimates of the Impact of the Poultry Processing Industry on Growth of Selected Indicators, 1990-2000

	Continuous		Gained		Lost		Both	
Indicator	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share	Employment Share	Wage Share
Income	0.31	0.32	-0.13	-0.52	0.02	0.03	0.47	0.38
	(0.88)	(0.19)	(0.16)	(0.44)	(0.03)	(0.01)	(0.57)	(0.37)
Wage	0.09	0.09	-0.47	-0.93	-0.79	-0.77	0.49	0.49
	(0.07)	(0.02)	(0.16)	(0.23)	(0.34)	(0.07)	(0.17)	(0.14)
Employment	0.99***	0.99	0.47	0.51	0.60	0.61	0.61	0.53
	(4.18)	(0.96)	(1.00)	(0.69)	(1.31)	(0.30)	(1.11)	(0.82)
Net Employment	-0.25	-0.25	-0.50	-0.55	-0.49	-0.49	-0.46	-0.57
	(1.07)	(0.25)	(0.88)	(0.74)	(1.07)	(0.24)	(0.83)	(0.89)
Total Govt Exp	-0.24	-0.25	-1.64***	-1.72**	0.32	0.31	-0.66	-1.30**
	(0.94)	(1.24)	(2.69)	(2.31)	(0.66)	(0.15)	(1.12)	(2.03)
Educ Govt Exp	-0.04	-0.04	0.47	0.15	0.14	0.10	-0.69	-1.22**
	(0.17)	(0.04)	(0.90)	(0.21)	(0.33)	(0.05)	(1.37)	(2.08)
Police Govt Exp	-0.35	-0.50	0.87	1.54	0.46	0.11	-0.30	-0.66
	(0.30)	(0.15)	(0.31)	(0.63)	(0.20)	(0.02)	(0.11)	(0.31)
Health Govt Exp	-1.32	-0.95	-8.21	-14.16	-3.94	-3.89	6.95	8.89
	(0.11)	(0.02)	(0.30)	(0.41)	(0.18)	(0.04)	(0.26)	(0.30)
Property Crime Rate	1.22	1.65	2.68	4.86	-2.71	3.95	3.94	-0.98
	(0.09)	(0.03)	(0.08)	(0.10)	(0.09)	(0.03)	(0.17)	(0.02)
Violent Crime Rate	-3.19	-2.82	6.99	10.62	-0.02	8.61	9.13	-0.55
	(0.17)	(0.03)	(0.14)	(0.15)	(<0.01)	(0.05)	(0.26)	(0.01)

Notes: t-statistics are in parentheses, * significant at the 10-percent level; ** significant at the 5-percent level; *** significant at the 1-percent level. Two measures of industry size are reported; employment share is the change in the proportion of poultry processing jobs in the county; wage share is the change in the proportion of poultry processing's wage bill in the county. Counties are classified into five groups; continuous, the poultry processing industry was present in the county continuously throughout the study period; gained, the county gained the industry; lost, the county lost the poultry processing industry; both, the county both gained and lost the industry during the study period; the omitted category is counties that never had the industry between 1990 and 2000.

The Influence of Education and Rural Background on Rural Residence Choice

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Abstract

Brain drain, the out-migration of young, college-educated workers from the nation's rural areas, is considered a serious threat to the social and economic vitality of rural America. Existing research on this topic focuses predominately on young adults shortly after they enter the job market and thus does not capture individuals' long-term preferences for locations. Location may not be a dominant factor in choosing one's first job out of school or preference for locations may change with age. This paper examines the residence choices of individuals using 1968-2001 data from the Panel Study of Income Dynamics. The findings imply that college educated individuals are less likely to choose rural residences; however, the gap appears to not be related to the rural nature of locations per se, but rather other attributes such as environmental amenities and the proportion of skilled workers in the county. The estimates further suggest that there is significant variation in preferences for rural locations in the population due to unobserved factors.

Introduction

> "Who's got permanence? Factory closes down, you move on. Good times and things opening up, you move on where it's better. You got roots you sit and starve....How many kids in America stay in the place where they were born, if they can get out?"
>
> John Steinbeck, *Travels With Charley*

Brain drain, the out-migration of young, college-educated workers from the nation's rural areas, threatens to undermine the social and economic vitality of rural America. Anecdotal accounts from the Midwest to Maine describe an exodus of young, college graduates, lured away by big city living and better-paying jobs. They leave behind communities that struggle to maintain public services for populations that are simultaneously shrinking and aging.

Declining numbers of skilled workers in a local community is not a trivial problem, yet it is not straightforward to measure. Nationwide the number of college graduates has steadily increased over the past few decades. In fact, between 1970 and 2000 the share of the population over age 25 with a college education rose in every U.S. county but five. In relative terms, however, some places are falling behind. Using Census data and a shift-share technique, Artz (2003) shows that there has been wide variation in the ability of U.S. regions to attract or retain college-educated workers over the thirty year period from 1970 to 2000. Counties that lost population over the time period tended to experience brain drain, a trend that greatly affected the Great Plains region, where more than one-third of the counties experienced population loss between 1970 and 2000. This region in particular has suffered from a kind of adverse selection, whereby more educated people, generally the most economically mobile, are the first to leave (Feser and Sweeney, 1998).

The relative loss of educated workers in rural regions is cause for concern. Recent studies have shown that capital and skilled labor are complements, so as advances in technology reduce the cost of capital, the demand for skilled workers increases. Other research suggests that the clustering of college-educated workers may have spillover effects, enhancing a region's productivity and the potential for economic growth. The trend also has implications for income inequality since the wage gap between those with a college degree and those without is widening.

Absent regional effects, metropolitan areas have gained college-educated workers at a faster rate than non-metropolitan and rural areas. Yet, there are exceptions. Rural and nonmetropolitan counties in the Mountain states, New England, Middle Atlantic and East North Central regions have had a relative advantage in attracting college graduates on average.

Most of the research on the question of brain drain has focused on recent college graduates in the very short time period after graduation. In general these studies find that college educated individuals are more likely to migrate from their home regions after completing school, drawn by higher returns to education in urban areas. They suggest that the economic conditions of the home region may influence migration decisions, but individual characteristics are more important for understanding who moves and who stays. If young, educated workers are moving into metropolitan areas to take advantage of higher returns to education, should we try to stop them?

Policies designed to keep rural area college graduates "home" when they would be better off someplace else are clearly inefficient from society's point of view. However, strategies to attract experienced college-educated workers may not be. The current debate over brain drain overlooks the possibility that individuals' reasons for moving and their preferences for certain locations may change with age. Younger people move to take advantage of school and job opportunities. But as people marry, have children and acquire job experience, they may choose to relocate for 'quality of life' reasons. There is little information about the motivations and choices of potential reverse migrants opting to relocate in mid-life. Policy makers should be concerned about the supply of all educated workers not just young educated workers.

Review of Related Literature

The brain drain phenomenon, as a question of out-migration, is readily analyzed as a migration choice. The decision to migrate or to stay can be viewed as an investment that, like education, increases the productivity of human resources (Sjaastad, 1962). When considering a move, an individual weighs the costs and returns, which are both monetary and non-monetary. The monetary return is simply the difference (positive or negative) in the future earnings an individual realizes from migrating. This difference encompasses the variation in wages, costs of working and costs of living between the origin and potential destination, as well as opportunity costs of moving. Non-monetary or psychic costs, including location-specific capital also influence an individual's decision. Location-specific human capital refers to the investment an individual may have in a particular place. This includes family ties and social networks as well as experience in an industry that is concentrated in a particular region, knowledge of the employment opportunities of a certain place, or general experience of living in a particular area (Da Vanzo, 1983; Dierx, 1988).

There is a large body of literature addressing the causes of internal migration. It is well established that younger people are more likely to move and that education increases the likelihood of migration (Greenwood, 1997). The particular concern surrounding "brain drain" is the perception that rural areas are losing people in general and college-educated people in particular[1].

Research on the question of brain drain in the U.S. has focused on the location decisions of individuals (in particular rural-born individuals) in the very short time period after graduation from college or high school (Kodrzycki (2001); Garasky (1992); Rodgers and Rodgers (1997); Mills and Hazarika (2001)). In general these studies provide evidence of rural area brain drain, finding that college educated individuals are more likely to migrate from their home regions after completing school, drawn by higher returns to education in urban areas. They suggest that the economic conditions of the home region may influence migration decisions, but individual characteristics are more important for understanding who moves and who stays.

Other empirical research has demonstrated that interstate differences in returns to skill are a major determinant of internal migration flows (Borjas, et al. 1992; Huang, Orazem and Wolhgemuth, 2002). There is a spatial mismatch between where people are born and the reward structure for their particular skills. As a result, people relocate in search of higher rewards for their specific skills. This problem is exaggerated in rural areas, where labor markets are especially "thin." The mismatch between labor demand for high-skills in rural areas and the skills of local educated youth contributes to out-migration from some rural areas (Mills and Hazarika, 2002; Huang et al. 2002). If spatial mismatch exists then we should expect people, especially young people, to migrate in order to find a better match.

The existing research on rural and college-educated migrants is limited in its usefulness for addressing the problem of "brain drain." It focuses almost exclusively on young adults, reflecting only "short-term" decisions, typically one to five year periods. Also, the research does not capture sequential migration decisions or repeat migration, which are potentially important to understanding the problem of brain drain. In short, these studies ignore the possibility that individuals' reasons for moving and their preferences for certain locations may change with age.

Many college-educated workers face national job markets and enter professions in which experience is important for career advancement. Younger people may move away from their home region after finishing school in order to find suitable entry-level positions. Once they gain experience in their professions, however, they may choose to move again. Feridhanusetyawan (1994) found that the likelihood of migrating increases as people age, but at a diminishing rate. In other words, young adults are increasingly likely to undertake long distance moves up to some pivotal age, at which point the probability they will migrate decreases with age. The peak tendency to move occurred around age 42 in his study's sample.

Younger people are less likely to be married, have children, or own their home, all factors which tend to increase the costs of moving and therefore reduce the likelihood of long-distance moves. These factors also influence the choice of metropolitan areas over more rural places. Married people with children are more likely to favor areas with affordable housing, lower crime rates and lower population densities (Feridhanusetyawan and Kilkenny, 1996). There is evidence that the migration decisions of adults in their 30s and 40s are influenced more by 'quality of life' and family issues and relatively less by job market opportunities (Graves; 1979; Sandefur, 1985; Feridhanusetyawan, 1994; Peri, 2001; Von Reichert, 2002). If people move away when very young, but return when in mid-life and much less likely to move again, the out-migration of recent college graduates may not be such a cause for concern.

There is a perception among some policymakers that former residents are attracted back to their own home areas. For example, Project Back Home tries to recruit former residents back to North Dakota. This approach assumes that people have location-specific capital--social or family ties or nostalgia for their hometown--that reduces the costs or increases the returns of return migration. The accumulation of location-specific capital at a prior residence should positively affect the probability of return migration (DaVanzo, 1988). Indeed, for some people, this may be the case. Feridhanusetyawan's research reports the more than half of repeat movers in his sample returned to their home state. But if a spatial mismatch exists, no amount of location-specific capital may be enough to offset the lack of employment opportunity in one's hometown. Instead, it may be that people prefer to "return" to any rural area in their home region or perhaps any rural setting at all (Herzog and Schlottmann, 1982).

This paper examines the rural/urban residence choice of individuals at four different ages, chosen to represent stages in the life cycle beyond the first move, to determine if the relative importance of individual characteristics for determining residential location changes as people age. In addition it incorporates a measure of rural experience in the model, to proxy for the importance of "home" in determining location choice at various life stages.

The paper proceeds as follows. The theoretical model and empirical strategy are outlined, followed by a description of the data used in the analysis. Results are presented and discussed. The paper concludes with a summary of the findings and suggestions for future research.

A Model of Location Choice

Individuals derive utility from their consumption of goods and services, housing, and environmental and non-environmental amenities. When considering where to live, all these factors enter into a location dependent utility function. Individuals evaluate their options each period and choose the location that will give them the highest level of utility subject to a budget constraint.

The choice of location includes the option of staying put. Since people acquire location-specific capital over time the utility they derive from their current location generally should increase with the length of time they have lived there. Thus, the longer a person has lived in a place, the less likely it is she will move.

Let an individual's indirect utility be represented by:

$$V_{njt} = V(w_{njt}, r_{jt}, a_j, C_{njt}) \qquad \forall j \in J \tag{1}$$

where w_{njt} represents the wage of individual n at location j at time t, r_j represents rent in location j at time t, a_j represents unpriced amenities in location j, and J is the set of all possible alternatives.

Let $C_{n0jt} = C(C_{i0t,} d_{i0\xrightarrow[j]{}})$ be comprised of a fixed cost of moving (including psychic costs, social ties represented by whether married, number of children, and length of time at current residence.) and a variable cost depending on j. This variable cost is measured by the straight line distance from the current residence to each potential destination. There is no variable cost of moving associated with staying in one's current residence. The fixed cost of moving tends to increase with the length of time an individual resides in any given location. The variable tenure denotes the number of years an individual has lived in their current location at time t, and is a measure of the build up of location specific capital over time. Let j=0 index an individual's residence location at time t. The individual's utility at her current location and all alternative destinations is given by:

$$V_{njt} = V(w_{njt}, r_{jt}, a_j, tenure_{0t}, d_{j0\xrightarrow[j]{}}) \tag{1a}$$

where tenure is a positive, non-zero value only for the individual's current location, j=0, and $d_{i0\xrightarrow[j]{}}$ is a positive, non-zero value for all locations except the current residence for which it equals 0.

Individuals are assumed to have perfect information. Period t consumption and location decisions are taken as given. At the end of each period, the person decides where to live next period (t+1) by determining which location will give her the highest level of utility over the remainder of her working lifetime:

$$V_{njt} = \int_0^T V_{nj}(\cdot)e^{-\rho\tau}d\tau \qquad (2)$$

where T is time left until a fixed retirement age, T*, and $e^{-\rho\tau}$ is a discount factor with the discount rate ρ. Time left until retirement is a function of an individual's current age, T=T*-age_n. Assuming individuals share a common discount factor and common functional form for indirect utility, the solution to equation (2) is:

$$LV_{njt} = \frac{1}{\rho}V_{ij}(\cdot)[1-\exp(-\rho T)] = \frac{1}{\rho}V_{ij}(\cdot)[1-\exp(-\rho(T^*-age_n)] \qquad (3)$$

If the optimal location is the decision maker's current residence, no migration will occur. If not, she will move. Therefore, the remaining working lifetime indirect utility for individual n in location j is[2]:

$$LV_{njt} = (\rho, w_{njt}, r_{jt}, a_j, C_{njt}, age_n) \qquad (4)$$

Every individual makes a decision every period; therefore non-migrants are included in the analysis. The model doesn't treat migration and location choice as separate decisions, but rather views the location choice as a realization of the migration choice.[3] In addition, individuals are assumed to take location attributes as exogenous to their decisions.

An individual will choose location i if and only if $LV_{ni} > LV_{nj} \forall j \neq i$. Assuming a linear-in-parameters indirect utility function, the probability the individual chooses alternative j is given by the following cumulative distribution:

$$\begin{aligned} P_{ni} &= \Pr(V_{ni} > V_{nj}, \forall j \neq i) \\ &= \Pr(\beta_n^{'} x_{ni} + \varepsilon_{ni} > \beta_n^{'} x_{nj} + \varepsilon_{nj}, \forall j \neq i) \\ &= \Pr(\varepsilon_{nj} - \varepsilon_{ni} < \beta_n^{'} x_{ni} - \beta_n^{'} x_{nj}, \forall j \neq i) \end{aligned} \tag{5}$$

Using the density $f(\varepsilon_n)$ equation (5) can be written as:

$$P_{ni} = \int_{\varepsilon} I(\varepsilon_{nj} - \varepsilon_{ni} < \beta_n^{'} x_{ni} - \beta_n^{'} x_{nj,} \forall j \neq i) f(\varepsilon_n) d\varepsilon_n \tag{6}$$

where I(·) an indicator function equal to 1 when the expression in parentheses is true and 0 otherwise.

Estimation Strategy

The model outlined above is a standard random utility model. Individuals are assumed to select the alternative that gives them the highest level of utility. Since the researcher can not observe all the characteristics of individuals and locations that affect this decision, the indirect utility associated with each alternative and each person is modeled as a random variable. In standard logit or probit models, unobserved heterogeneity enters only through the error term, ε_{nj}. Variation in individuals' preferences can be incorporated by interacting socioeconomic characteristics with attributes of the choices. This is somewhat restrictive since tastes may only vary with observed characteristics of individuals. In contrast, the random coefficients approach allows for heterogeneity arising from unobserved sources. In these models taste variation among individuals is incorporated by allowing coefficients to vary over decision makers in the population. The indirect utility for person n and alternative j is:

$$LV_{nj} = \beta_n' x_{nj} + \varepsilon_{nj} \tag{7}$$

where x_{nj} is a vector of observed variables relating to alternative j and individual n, β_n is a vector of coefficients for person n representing her tastes, and ε_{nj} is a random disturbance term that is iid extreme value. Another advantage of the mixed logit model relative to a standard logit model, is that mixed logit is not restricted by the independence of irrelevant alternatives (IIA). This property of multinomial logit models implies that probability ratios between two choices are independent of any other alternatives in the choice set. With mixed logit, changes in the attribute of one alternative need not affect the remaining alternatives proportionately.

With this specification, the coefficients vary over decision makers in the population with density $f(\beta)$, itself a function of parameters θ. For example, if the distribution of β is specified as normal, θ would consist of the mean and variance of β. Both the value of β_n and ε_{nj} are known to the decision maker who chooses alternative i if and only if $LV_{ni} > LV_{nj} \forall j \neq i$. The researcher only observes x_{nj}. If the researcher could observe β_n then the choice probability would be standard logit. In other words, conditional on knowing β_n the probability of choosing alternative i is

$$L_{ni}(\beta) = \frac{e^{\beta_n' x_{ni}}}{\sum_j e^{\beta_n' x_{nj}}} \tag{8}$$

Since the researcher does not observe β_n, he cannot condition on β. The unconditional choice probability is obtained by integrating $L_{ni}(\beta)$ over all possible values of β_n.

$$P_{ni} = \int L_{ni}(\beta) f(\beta|\theta) d\beta \tag{9}$$

is the mixed logit probability, the probability individual n chooses alternative i, and $f(\beta|\theta)$ is the distribution of β in the population with parameters, θ, called the mixing distribution. The mixing distribution captures variance and correlation in unobserved factors. The researcher specifies the mixing distribution and estimates the parameters, θ. For instance, if the density of β is specified to be normal, the mean and variance of the distribution are estimated. Note that the choice probabilities are functions of θ and do not depend on the β's, which are integrated out to obtain the choice probabilities.

The mixed logit model allows the effect of location and personal characteristics to vary across individuals in the population. For example, while some people might prefer rural residence locations, others may view them as undesirable places to live, for reasons not observed by the researcher. The mixed logit specification accommodates this variation, enabling the researcher to estimate both the mean and the variance of preferences for attributes in the population.

Simulation is used to estimate this model. The researcher takes random draws from the distribution of β, β^r and calculates the conditional choice probability, $L_{ni}(\beta^r)$. This is repeated for a specified number of repetitions, R (in this case 500), and the result is averaged to obtain an unbiased estimator of P_{ni}:

$$\breve{P}_{ni} = \frac{1}{R}\sum_r L_{ni}(\beta^r) \tag{10}$$

These simulated probabilities are inserted into the log-likelihood function to give simulated log-likelihood (SLL):

$$SLL = \sum_{n=1}^{N}\sum_{j=1}^{J} d_{nj} \ln \breve{P}_{nj} \tag{11}$$

where $d_{nj} = 1$ if individual n chose alternative j and 0 otherwise. The maximum simulated likelihood estimator (MSLE) is the value of θ that maximizes SLL.

Panel data

The mixed logit model is easily modified to accommodate panel data. The simplest specification treats repeated choices by individuals in the sample as constant over choice situations:

$$V_{njt} = \beta'_n x_{nj} t + \varepsilon_{njt} \tag{12}$$

where V_{njt} denotes indirect utility for person n from alternative j at time t. The error terms are iid extreme value over people, alternatives and time[4]. Repeated choices are viewed as a sequence, one for each time period, **i** $=\{i_1,\ldots,i_T\}$. The choice probability for this sequence of choices, conditional on β, is the product of the conditional logit formula given by equation (8):

$$L_{ni}(\beta) = \prod_{t=1}^{T}\left[\frac{e^{\beta'_n x_{nit}}}{\sum_j e^{\beta'_n x_{njt}}}\right] \tag{13}$$

The unconditional probability is obtained by integrating over the possible values of β:

$$P_{ni} = \int L_{ni}(\beta) f(\beta|\theta) d\beta \tag{14}$$

In order to capture the effects of past behavior on current choices, lagged values can be added to the model. The inclusion of the variable, $tenure_t$, captures the influence of past residence choices on the current period's decision, and thus, correlation in individuals' decisions over time.

Choice Set

In this model, the full set of alternatives consists of 3,103 U.S. counties. While theoretically, the model can accommodate choices among the full set of alternatives, in practice, a large number of alternatives is computationally burdensome. In order to reduce this burden, a subset of fifty randomly sampled counties, including the actual choice, is constructed for each individual. As long as each alternative in the subset has a positive probability of being an observed choice, McFadden (1978) shows that consistent estimates of the parameters can be obtained. Let J denote the full set of alternatives and D_n represent the subset of randomly chosen alternatives for individual n. Each person's observed choice must be included in this set. The probability of individual n choosing alternative i given the subset of alternatives, D_n is:

$$L_{ni}(\beta)|D_n = \frac{e^{\beta_n' x_{ni} + \ln P_n(D_n|i)}}{\sum_j e^{\beta_n' x_{nj} + \ln P_n(D_n|j)}} \quad (15)$$

where $P_n(D_n|i)$ is the probability of creating the subset D_n given that alternative i is chosen. The addition of this term corrects for the bias introduced by the sampling of alternatives. If the subset is constructed through random sampling, McFadden's uniform conditioning property holds, implying that $P_n(D_n|i) = P_n(D_n|j)\ \forall i, j \in D_n$. In words, the probability of drawing the sample is the same regardless of which alternative is actually chosen. In this case, the ln $P_n(D_n|i)$ terms cancel, and equation (15) reduces to:

$$L_{ni}(\beta) = \frac{e^{\beta_n' x_{ni}}}{\sum_{j \in D_n} e^{\beta_n' x_{nj}}} \quad (16)$$

The only modification made is to replace each individual's choice set with D_n instead of the full choice set J[5].

Data

This research uses data from the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal dataset collected by the Institute for Social Research at the University of Michigan. This data consists of a sample of households selected in 1968 and re-interviewed every year up to 1996; subsequent to this date, households are interviewed biannually. The most recent data included in this research are from 2001[6]. For this research, individuals' locations and personal characteristics are observed at ages 15, 25, 30, 35 and age 40[7]. Individuals must be observed at each time period in order to be included in the sample. It is assumed that an individual's location at age 15 is determined by their parents and is therefore exogenous.

Including repeated observations on individuals over time is intended to capture differences between the location choices of recent college graduates and those of "family-stage" adults in their 30s and 40s who may be differentially influenced by job and amenity or family related factors.

Counties are classified as rural based on the decade's Beale codes[8]. Rural is meant to capture the relative population density of a county and is defined as living in a county with a Beale Code of 6 or higher (6 through 9). These codes change over time, however, so a county's status as rural can change over time. For example, in 1975, Dallas County, Iowa, would be considered rural since Dallas County's 1974 Beale Code was 6. A decade later, this county would be considered metropolitan, since Dallas County's 1983 Beale Code was 2.

Beale codes are also used to determine adjacency to a metropolitan area. Adjacency is included to measure access to urban areas. Presumably a nonmetropolitan county in close proximity to a metropolitan area offers a set of locational attributes quite different from rural counties that are more remote. In particular, nonmetropolitan adjacent counties might offer the best of both worlds for some individuals: a rural setting paired with access to increased job opportunities and cultural amenities found in cities. *Adjacent* is a dummy variable that equals one if the county's Beale Code is 4, 6 or 8, and equals zero otherwise. *Non-Adjacent* takes a value of one if the county's Beale Code is 5, 7, or 9; else it is zero. Metropolitan counties (Beale Codes 0 to 3) are the excluded category. The coefficient for each of these is specified as a normally distributed random parameter in order to capture heterogeneity of preferences that may exist in the population.

Other county attributes included in the model are the distance from county j to county 0, the individual's county of residence at time t. This measures the variable cost of moving, which should increase with distance moved; thus the coefficient on *Distance* is expected to be negative. Since some individuals may have a greater aversion to moving long distances than others, the coefficient is also specified as a normally distributed random variable. *Distance home* measures the straight line distance from each alternative to the individual's county of residence at age 15. This measure is included to assess the importance of location-specific capital associated with the area in which an individual was raised. The coefficient is specified as a normally distributed random parameter. Some individuals may place greater value on being close to "home" than others. The USDA natural amenities index (*Amenities*) primarily measures climatic differences among counties. In general, higher values are associated with more desirable environmental attributes; *Amenities* is expected to be positively related to the choice probability; however, the coefficient is specified as normally distributed to capture variation in preferences for these climatic attributes. The proportion of the county residents with four years of college or more measures the level human capital in the county. Since higher levels of human capital are positively related to wage growth, the coefficient on *College Share* should be positive. *Rent* is the county's median gross rent obtained from the U.S. Census Bureau. This captures variation in the cost of living among counties; all else equal, higher values should lower the probability of choosing the location.

Expected wages for each individual in each location are not modeled explicitly. Instead, individual characteristics and two measures of local labor demand, *Employment Growth* and *Average Per Capita Income* are included. *Employment Growth* is measured as the average growth in county employment for the five years prior to the observation; *Average Per Capita Income* is also averaged over this five year period. These data come from the Bureau of Economic Analysis. Higher values of both are expected to increase the probability of choosing a county.

Another measure of location specific capital included in the model is *tenure*, the number of years the individual resided in her current location at time t. This term enters the choice probability in a non-linear fashion with the inclusion of *tenure squared.* It is expected that the effect of location specific capital will increase at an increasing rate over time. That is, the longer an individual has lived in a particular place, it is increasingly unlikely she will move. Both the coefficients on *tenure* and *tenure squared* are specified as random parameters. $Location_t$ is a dummy variable indicating an individual's residence choice at time t. This is included to control for differential probability that may occur due to subsetting the choice set.

Education is a dummy variable that takes a value of 1 if an individual has 16 or more years of schooling and a value of 0 otherwise. In most cases this measure does not vary over time; also, it is invariant across locations. Therefore it will have no impact on the utility function if it enters as a linear term. Instead, it is incorporated into the model through interactions with location attributes. *Education* is interacted with both *Amenities* and *College Share* to reflect the ideas that more highly educated individuals may place greater value on environmental amenities and that there may be differential returns to education across locations. Research has shown that college educated individuals are more productive in places with higher levels of other college educated people due to agglomeration effects (for example, see Glaeser and Mare, 2001; Glaeser and Shapiro, 2003). The coefficients on both these interaction terms are expected to be positive. *Education* is interacted with *tenure*, since previous studies have shown that educated people tend to move more frequently, the sign on this coefficient should be negative. Finally, *Education* is interacted with *Rural* to assess whether higher levels of education affect the probability an individual chooses a rural location. Other individual attributes included are *Married, Male, Number of Young Children* and *Age*. Each of these is interacted with *Rural* to examine the influence of personal attributes on choosing a rural location.

Table 3.1 provides a list of variables used in the analysis. Descriptive statistics for the sample are presented in table 3.2. Weighted means for individual characteristics, adjusting for the sampling design of the PSID, are provided.

Results

Estimates from three variations of the mixed logit model are presented in table 3.3. All are estimated by maximum simulated likelihood methods with a choice set of 50 county alternatives.[9] Model A includes only county attributes and the location specific capital measures, tenure and distance home. Model B adds the effect of a college education. Model

C includes other personal attributes interacted with *Rural*. The likelihood ratio test of the joint significance of the additional regressors is reported in the bottom row of the table. The coefficients are very stable across specifications.

In general, the county attributes have the expected signs. *Average Per Capita Income* increases the probability of choosing a location as do higher values of *College Share*. Higher values of *Rent*, a measure of cost of living, decrease the likelihood of choosing a destination. *Employment growth* is negatively related to the choice probability, which contrary to expectations, implies that people do not move in response to employment growth. Physical distance decreases the likelihood of choosing a county; however, there is significant variation in the population regarding the effect of distance. Similarly, physical distance to an individual's home county lessens the probability of choosing a destination, and again there is significant variation in this parameter. Rural and non-metropolitan locations are less likely to be chosen relative to more urban locations, but the estimates indicate that the coefficients vary significantly in the population. The coefficient on *Adjacent*, although negative is less so than the coefficient for *Non-Adjacent* suggesting that, on average, areas in close proximity to cities are preferable to more remote locations. Higher levels of *tenure* in a location increase the choice probability, as expected.

The effect of having college education on the choice probabilities is jointly significant at the 1% level. Thus, there are significant differences in the factors that determine location choice for college educated individuals relative to those with less than a college degree. Individuals with a college education place a greater value on locations with higher shares of college educated residents. This is consistent with agglomeration effects suggested by theory. The positive coefficient on the interaction between *Education* and *Amenities* suggests that college educated individuals on average place greater value on natural amenities. Having a college education reduces the effect of tenure on location choice, consistent with the evidence from previous research that shows more highly educated individuals move more often. The coefficient on the interaction between *Education* and *Rural* is not significant. This implies that, all else equal, college educated individuals are not less likely to choose a rural residence relative to individuals with less than a college education.

The addition of individual characteristics should reduce the variability in preferences if the observed characteristics are correlated with the unobserved heterogeneity. The introduction of individual attributes such as gender, age, marital status and number of young children have virtually no effect on the estimated standard deviations of the random parameters. The positive coefficients on *Age * Rural*, *Married * Rural* and *# Young Children * Rural* suggest that older and married individuals and those with young children are more likely to choose rural locations, but the likelihood ratio statistic fails to reject the null hypothesis that individual attributes do not affect taste for rural areas. These attributes play little role in the probability of choosing a rural location and are unable to account for the heterogeneity present among individuals in the sample.

Preference Heterogeneity

The significance of the standard deviations of the random coefficients in table 3.3 provides evidence of preference heterogeneity in the population arising from unobserved sources. Figure 3.1 shows the distribution of the coefficient on *Rural.* The estimates imply that for 28.6% of the population, *Rural* is a positive attribute, yet less than 20 % of the individuals in the sample reside in a rural county at each of the age levels analyzed. This suggests that for approximately 10% of the population, other, unobserved factors outweigh the potential pull of rural locations. There is less variance in the coefficients for *Adjacent, non-metropolitan* and *Non-adjacent non-metropolitan* counties. The estimates for these attributes imply that only 5.2% of the population prefer non-adjacent, non-metropolitan counties over metropolitan counties and an even smaller fraction, 1.1%, prefer adjacent, non-metropolitan locations relative to metro areas. Figure 3.2 plots the distribution for the coefficient on *Distance home*. For approximately 88% of the population, this coefficient is negative, so that the further away is a potential destination from an individual's home county, the less likely she will choose it. For most people, proximity to home, one measure of location specific capital, is important in the location choice decision. Preferences for *Amenities*, an index of climate and topography related variables, also appears to vary somewhat in the population. While approximately 71% of the population prefers locations that are associated with higher amenity index values (generally, locations that are warmer, less humid and more mountainous), for a sizable segment of the population, these attributes are less appealing. The variation in preferences demonstrated by these estimates suggests that policies seeking to attract potential migrants to rural locations might be the most successful if they are targeted to particular segments of the population.

Estimated Effects of County Attributes

In order to provide a sense of the magnitude of estimated effects, own county elasticities of the choice probabilities with respect to selected county attributes are presented in table 3.4. The effect of a given attribute, x_i on the probability of an individual n choosing county i in elasticity form is:

$$\eta_i = \frac{\partial P_{ni}}{\partial x_{ni}} \frac{x_{ni}}{P_{ni}} = \int \beta x_{ni}(1 - L_{ni}) \frac{L_{ni}}{P_{ni}} f(\beta) d\beta \quad (17)$$

Own elasticities are computed for all individuals at each age using simulation and averaged over all 3,103 county alternatives. Table 3.4 reports averages over all individuals and all counties as well averages for all individuals over the set of rural counties and the set of urban counties. The effects of the county attributes on choice probabilities vary noticeably with age. For example, a one percent increase in a county's per capita income level would cause, on average, a 0.305 percent increase in the probability of an individual choosing to live in that county at age 25. By age 40, the effect is more than double at 0.697. Similarly, the elasticities with respect to *College Share* increase with age, with the average elasticity at age 40 approximately forty percent larger that the average elasticity at age 25. Individuals appear to respond less to *Amenities* over time, but the estimates for these elasticities and for

Employment Growth are imprecise. In all cases, individuals are less responsive to changes in rural county attributes than urban county attributes.

Estimated Effects of College Education

Figure 3.3 plots the estimated probabilities of choosing rural for individuals with and without a college education at ages 25, 30, 35 and 40. The solid lines in the figure show the probabilities for choosing rural counties when current definitions of rural are applied. The dashed lines show the estimated choice probabilities for rural when a constant, 1970 definition of rural is used.

In all cases, having a college education reduces the probability of choosing a rural residence location relative to an individual with less education. At age 25, the probability an individual with a college education chooses to reside in a rural county is about twenty percent less than the corresponding probability for an individual without a college education. By age 40, the probability of choosing a rural location has fallen for both types of individuals and the gap between those with a college degree and those without is more than twice as wide as it was at age 25.

However, much of the decline in the choice probability for rural can be explained by the changing rural status of U.S. counties. When a constant definition of rural is applied, there is virtually no change over time in the probability an individual with less than a college degree will choose to live in a rural county. The probability of choosing rural still falls over time for individuals with a college education; however, the decline is much smaller relative to the estimates derived with a changing definition of rural. These estimates are consistent with the anecdotal evidence of a brain drain from rural areas, but show that, in the aggregate, the trend is exaggerated by the shifting nature of what is rural.

Conclusion

This research has provided some insight for understanding what types of individuals choose rural residences. The findings do imply a brain drain from rural to urban counties since individuals with higher levels of education are less likely to choose a rural residence at any of the ages included in this analysis. However, at least some portion of the change in probability of choosing rural over time is due to the decline in the number of places that are considered rural. Also, the results suggest that it is not the rural nature of a location, but other attributes, such as amenities and the proportion of skilled workers that create the gap in rural residence choice between those with a college degree and those without. Furthermore, the estimates show that preferences for rural locations vary significantly in the population due to unobserved factors, and the implied proportion for whom rural is a positive attribute exceeds the present proportion living in rural areas. Thus, for a sizeable number of individuals, other, unobservable factors outweigh the pull of rural character in their location decision. Clearly, further research into the sources of this heterogeneity is needed.

A number of strategies for recruiting and retaining college graduates in the nation's more rural states have been proposed in recent years, from tax incentives for science and technology graduates to letter-writing campaigns inviting former residents to return "home." There is ample anecdotal evidence of people choosing to return to the region in which they grew up, perhaps to be close to aging parents or due to established social or job networks. These findings provide some empirical evidence of the importance of home for location choice and lend support for the potential efficacy of policies designed to attract former residents to more rural areas. Also, they suggest that individuals become more responsive to changes in attributes like per capita income levels and the proportion of college educated residents as they age. Strategies to recruit individuals in their thirties and forties might be more successful than those that focus on keeping younger individuals home.

Endnotes

[1] Much of the economic literature on "brain drain," considers international migration. Less developed nations experience brain drain when their educated citizens emigrate to developed nations because they realize a higher return to education abroad or because of asymmetric information in labor markets (Kwok and Leland, 1982; Lien, 1985; Beine, et al., 2001; Mountford, 1997; Wong and Yip, 1999).

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[2] In the empirical specification, the discount rate which is assumed to be the same across alternatives and individuals does not affect utility. Age enters only through interactions with location attributes, since it does not vary across locations.

[3] This model assumes that individuals re-evaluate their decision each period, given their current situation. It does not accommodate a view of migration as an problem of optimal timing.

[4] This specification allows coefficients to vary over people, but constrains them to be constant over choice situations for each person. An extension would be to allow the coefficients to vary over time as well. See Train, p. 150.

[5] In this application, both the period t choice and the period t-1 choice, if they are different, are included in the subset. This method may violate the uniform conditioning property. To investigate the implications of this specification, the model was estimated using 10, 20 and 50 alternatives. The results are presented in appendix A. There is a tradeoff between the level of efficiency of the parameters and computational burden. Clearly, the greater the number of alternatives included in the subset, the closer the estimation is to the full model. Table A1 shows that there are a number of differences between the model that uses only 10 alternatives and those using 20 and 50 alternatives. In some cases, signs of the parameter estimates change. The main difference between the estimates using 20 and 50 alternatives is the significance level of the standard deviation estimates for the random parameters. The model specified with 50 alternatives suggests there is significant variation in individuals' preferences for rural and non-metropolitan locations, while the 20-alternative specification provides less evidence of heterogeneity of preferences. Since in the limit, the parameter estimates using a subset of alternatives should converge to the estimates of the full model, the 50-alternative specification is chosen.

[6] Some of the data in this analysis are derived from Sensitive Data files of the Panel Study of Income Dynamics, obtained under special contractual arrangements designed to protect the anonymity of respondents. These data are not available from the authors. Persons interested in obtaining PSID Sensitive Data Files should contact PSID through the Internet at PSIDHelp@isr.umich.edu.

[7] Since PSID households are not interviewed at the same time each year, it is possible to observe individuals in the survey twice at the same age. Therefore, two year intervals about the target age were chosen to avoid inadvertent omissions. For example, only selecting individuals at age 15 would omit someone who never appears at age 15, but instead appears twice at age 14. Also, to increase the size of the sample, individuals first appearing at age 16 or 17 were also included.

[8] Beale codes are defined as follows:

1	Metro areas of 1 million population or more.
2	Counties in metro areas of 250,000 to 1 million population.
3	Counties in metro areas of fewer than 250,000 population.
4	Urban population of 20,000 or more, adjacent to a metro area.
5	Urban population of 20,000 or more, not adjacent to a metro area.
6	Urban population of 2,500 to 19,999, adjacent to a metro area.
7	Urban population of 2,500 to 19,999, not adjacent to a metro area.
8	Completely rural or less than 2,500 urban population, adjacent to a metro area.
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area.

For more detailed information, see http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes/.

[9] The model is estimated using code written by Kenneth Train and Paul Ruud, freely available at http://elsa.berkeley.edu/~train/software.html. The model includes 50 alternatives and use 500 iterations in the simulation.

References

Artz, Georgeanne. 2003. "Rural Area Brain Drain: Is It a Reality?" *CHOICES*.

Aldrich, Lorna and Lorin Kusmin. 1997. "Rural Economic Development: What Makes Rural Communities Grow?" Economic Research Service, Agriculture Information Bulletin No. 737.

Angrist, Joshua, and Alan Kreuger. 1999. "Empirical Strategies in Labor Economics." Chapter 23 in O. Ashenfelter and D. Card, eds., *The Handbook of Labor Economics* Vol. III. North Holland.

Beine, Michel, Frederic Docquier, and Hillel Rapoport. 2001. "Brain drain and economic growth: theory and evidence." *Journal of Development Economics*, 64: 275-289.

Borjas, George J., Stephen G. Bronars, and Stephen J. Trejo. 1992. "Self-Selection and Internal Migration in the United States." *Journal of Urban Economics* 32:159-185.

Bound, John, Jeffrey Groen, Gabor Kezdi and Sarah Turner. 2001. "Trade in University Training: Cross-State Variation in the Production and Use of College-Educated Labor." Working Paper 8555, National Bureau of Economic Research.

DaVanzo, Julie. 1983. "Repeat Migration in the United States: Who Moves Back and Who Moves On?" *The Review of Economics and Statistics* 64:552-559.

Dierx, Adriaan H. 1998. "A Life-Cycle Model of Repeat Migration." *Regional Science and Urban Economics* 18: 383-397.

Dresher, K., "Local Public Finance and the Residential Location Decisions of the Elderly." Ph.D. Dissertation, University of Wisconsin, 1994.

Falaris, Evangelos. 1987. "A Nested Logit Migration Model with Selectivity." *International Economic Review* 28(2):429-443.

Falaris, Evangelos. 1988. "Migration and Wage of Young Men." *Journal of Human Resources* 23(4):514-534.

Feridhanusetyawan, Tubagas. 19974. "Determinants of Interstate Migration in the United States: A Search Theory Approach." Unpublished disseration, Iowa State University, Ames, Iowa.

Feridhanusetyawan, Tubagas and Maureen Kilkenny. 1996. "Rural/Urban Residence Location Choice." Working Paper 96-WP 157, Department of Economics, Iowa State University.

Feser, Edward J. and Stuart H. Sweeney. 1998. "Out-migration, Population Decline, and Regional Economic Distress." Economic Development Administration.

Garasky, Steven. 1999. "Understanding the Employment Experiences and Migration Patterns of Rural Youth and Young Adults." Unpublished manuscript, Iowa State University.

Glaeser, Edward L. and David C. Mare. 2001. "Cities and Skills." *Journal of Labor Economics* 19(2):316-342.

Glaeser, Edward L. and Jesse M. Shapiro. 2003. "Urban Growth in the 1990s: Is City Living Back?" *Journal of Regional Science* 43(1):139-165.

Gottlieb, Paul D. 2003. "Brain Drain Policies in the U.S. States: Treating the Symptom Instead of the Disease?" Working Paper, Department of Agricultural, Food, and Resource Economics, Rutgers, University.

Graves, Philip E. 1979. "A Life-Cycle Empirical Analysis of Migration and Climate, by Race." *Journal of Urban Economics* 6:135-147.

Greene, William H. 2000. Econometric Analysis. New Jersey: Prentice Hall Inc.

Greenwood, Michael J. 1997. "Internal Migration in Developed Countries." Chapter 12 in *Handbook of Population and Family Economics*, M.R. Rosenzweig and O. Stark, eds. Elsevier Science B. V.

Heminway, Merritt T. 2002. "Maine's Disappearing Youth: Implications of a Declining Youth Population." Paper prepared for Maine Leadership Consortium, Augusta, Maine.

Herriges, Joseph A. andn Daniel J. Phaneuf. 2002. "Inducing Patterns of Correlation and Substitution in Repeated Logit Models of Recreation Demand.: *American Journal of Agricultural Economics* 84(4): 1076.1090.

Herzog, Henry W. and Alan M. Schlottmann. 1982. "Moving Back vs. Moving On: The Concept of Home in the Decision to Remigrate." *Journal of Regional Science* 22(1): 73-82.

Hill, Martha S. 1992. The Panel Study of Income Dynamics: A User's Guide. Newbury Park, CA: Sage Publications, Inc.

Huang, Tzu-Ling, Peter F. Orazem and Darin Wohlgemuth 2002. "Rural Population Growth, 1950-1990: The Roles of Human Capital, Industry Structure and Government Policy." *Amer. J. Agr. Econ.* 84:615-627.

Jacobson, Jim, "Iowa brain drain: Most UI grads and many from ISU, UNI leave." *Cedar Rapids Gazette*, January 10, 2002.

Kiefer, Nicholas M. 1988. "Economic Duration Data and Hazard Functions." *Journal of Economic Literature*, XXVI:646-679.

Kodrzycki, Yolanda. 2001. "Migration of Recent College Graduates: Evidence from the National Longitudinal Survey of Youth." *New England Economic Review* Jan/Feb :13-34.

Kwok, Viem and Hayne Leland. 1982. " An Economic Model of the Brain Drain." *The American Economic Review*, 72(1):91-100.

Lee, Lung-Fei. 1983. "Generalized Econometric Models with Selectivity." *Econometrica*, 51(2):507-512.

Lien, Da-Hsiang Donald. 1987. "Economic Analysis of Brain Drain." *Journal of Development Economics*, 25:33-43.

McFadden, Daniel. 1978. "Modelling the Choice of Residential Location." Chapter 3. in A. Karlquist, L. Lundquist, F. Snickars and J. Weibull, eds., Spatial Interaction Theory and Planning Models. New York, New York: North-Holland Publishing Co.

McGranahan, Daivd A. and Calvin L. Beale. 2002. "Understanding Rural Population Loss." *Rural America* 17:2-11.

"Midwest cities, states worry about losing best and brightest students." The Associated Press, February 27, 2000.

Mills, Bradford and Gautam Hazarika. 2001. "The Migration of Young Adults From Non-Metropolitan Counties." *Amer. J. Agr. Econ.* 83:329-340.

Mincer, Jacob. 1978. "Family Migration Decisions." *Journal of Political Economy.* 86:749-773.

Mountford, Andrew. 1997. "Can a brain drain be good for growth in the source economy?" *Journal of Development Economics*, 53:287-303.

Peri, Giovanni. 2001. "Young People, Skills and Cities." CESifo Working Paper No. 610.

Rauch, James E. 1993. "Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities." *Journal of Urban Economics* 34:380-400.

Ritsila, Jari and Mark Ovaskainen. 2001. "Migration and regional centralization of human capital." *Applied Economics* 33:317-325.

Roback, Jennifer. 1982. "Wages, Rents and the Quality of Life." *Journal of Political Economy* 90(6):1257-1278.

Robinson, Chris and Nigel Tomes. 1982. "Self-selection and interprovincial migration in Canada." *Canadian Journal of Economics*, 15:474-502.

Rodgers, John L. and Joan R. Rodgers 1997. "The Economic Impact of Rural-to-Urban Migration in the United States: Evidence for Male Labor-Force Participants." *Social Science Quarterly*, 78(4):937-954.

Sandefur, Gary and Wilber Scott. 1981. "A Dynamic Analysis of Migration: An Assessment of the Effects of Age, Family and Career Variables." *Demography*, 18(3):355-368.

Sandefur, Gary. 1985. "Variations in Interstate Migration of Men Across the Early Stages of the Life Cycle." *Demography*, 22(3):353-366.

Sjaastad, Larry. 1962. "The Costs and Returns of Human Migration." *Journal of Political Economy* 70(5):80-93.

Steinbeck, John. 2002. Travels With Charley in Search of America. Steinbeck Centennial Edition. New York, New York: Penguin Books.

Train, Kenneth E. 2003. Discrete Choice Methods with Simulation. Cambridge, UK: Cambridge University Press.

Von Reichert, Christiane. 2002. "Returning and New Montana Migrants: Socio-economic and Motivational Differences." *Growth and Change* 33:133-151.

Whitacre, Brian and Bradford Mills. 2003. "Bridging the Metropolitan-Nonmetropolitan Digital Divide in Home Internet Use." *Choices*.

Wong, Kar-yiu and Chong Kee Yip. 1999. "Education, economic growth and brain drain." *Journal of Economic Dynamics and Control*, 23:699-726.

Table 3.1. Descriptions and Sources of Variables

Variable	Description	Source
Individual Characteristics		
Male	Dummy variable=1 if male; 0 if female	PSID
Age	Age in years	PSID
White	Dummy variable = 1if white; 0 otherwise	PSID
Marital Status	Dummy variable = 1if married; 0 otherwise	PSID
Number of Young Children	# of children age 5 and under	PSID
College	Dummy variable equal to 1 if individuals has 16+ years of education	PSID
Tenure	# of years living in current residence	PSID
Prior Rural Experience	# of years living in a rural location	PSID
Location Characteristics		
Amenities	USDA Natural Amenities Index	ERS
Rent	Median gross rent in the county (1970, 1980, 1990, 2000)	U.S. Census
College Educated Share	Proportion of county residents with a 4+ years of college	U.S. Census
Average Per Capita Income	County per capita income, average previous five years	BEA
Employment Growth	Average rate of employment growth, previous five years	BEA
$Location_t$	Dummy variable=1 if county of residence at t	PSID
Rural	Dummy variable =1 if county Beale code 6-9; 0 otherwise	ERS
Adjacent	Dummy variable =1 if county is non-metropolitan adjacent to a metro (Beale codes 4, 6 or 8)	ERS
Non-adjacent	Dummy variable =1 if county is non-metropolitan not adjacent to a metro (Beale codes 5, 7 or 9)	ERS

Table 3.2. Summary Statistics

Variable	Age 25 Mean	Age 25 Std. Dev.	Age 30 Mean	Age 30 Std. Dev.	Age 35 Mean	Age 35 Std. Dev.	Age 40 Mean	Age 40 Std. Dev.
Age_{t+1}	24.9	0.26	29.9	0.23	34.9	0.27	39.7	0.46
$Married_{t+1}$	0.53	0.50	0.66	0.49	0.69	0.48	0.68	0.49
Rural $Experience_{t+1}$	2.20	4.86	3.02	6.40	3.81	7.92	4.46	9.20
$College_{t+1}$	0.23	0.37	0.26	0.40	0.28	0.41	0.28	0.41
# Children $<6_{t+1}$	0.58	0.85	0.67	0.81	0.49	0.73	0.26	0.58
Male	0.47	0.50	0.47	0.50	0.47	0.50	0.47	0.50
White	0.80	0.50	0.80	0.50	0.80	0.50	0.80	0.50
$Year_{t+1}$	1981	3.41	1986	3.33	1991	3.36	1996	3.21
$Tenure_t$	8.74	5.56	10.77	6.84	14.22	8.60	16.38	10.10
Ave. Income Per $Capita_{0,t+1}$	9,248	3,511	13,687	4,384	18,009	5,441	22,101	6,409
Manuf. $Share_{0,t+1}$	0.18	0.09	0.16	0.09	0.14	0.08	0.13	0.08
Emp. $Growth_{0,t+1}$	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
Amenity $Index_{0,t+1}$	0.41	2.91	0.68	3.01	0.61	3.01	0.67	2.98
$Rent_{0,t+1}$	241.65	112.73	335.13	129.74	399.67	158.86	150.78	133.37
$Beale_{0,t+1}$	2.42	2.54	2.13	2.42	2.00	2.43	1.96	2.35
College $Share_{0,t+1}$	0.14	0.06	0.17	0.07	0.19	0.08	0.21	0.08

Notes: Means provided for individual characteristics are weighted by the PSID sampling weights.

Table 3.3. Parameter Estimates for the Model of County Choice

	Model A		Model B		Model C	
Variable	Parameter Estimate	Std Error	Parameter Estimate	Std Error	Parameter Estimate	Std Error
College Share	0.05***	0.01	0.05***	0.01	0.05***	0.01
Rent	-0.13***	0.01	-0.13***	0.01	-0.13***	0.01
Tenure dummy	-2.60***	0.13	-2.57***	0.13	-2.54***	0.13
College Educ * Tenure			-0.13***	0.04	-0.13***	0.04
College Educ * Amenities			0.10**	0.05	0.10**	0.05
College Educ * College Share			0.03**	0.01	0.03**	0.01
College Educ * Rural			-0.02	0.27	-0.09	0.28
Average Per Capita Income	0.04***	0.01	0.03***	0.01	0.03***	0.01
Employment Growth	-4.28***	1.15	-4.15***	1.15	-4.21***	1.16
Age * Rural					0.02	0.01
Married * Rural					0.10	0.15
# Young Children * Rural					0.07	0.15
Male * Rural					-0.01	0.10
Amenities (mean)	0.16***	0.02	0.15***	0.02	0.15***	0.02
Amenities (std. dev.)	0.28***	0.03	0.27***	0.03	0.27***	0.03
Distance (mean)	-0.37***	0.03	-0.36***	0.03	-0.37***	0.03
Distance (std. dev.)	0.46***	0.02	0.45***	0.02	0.46***	0.02
Rural (mean)	-0.71***	0.12	-0.71***	0.13	-1.37***	0.49
Rural (std. dev.)	1.26***	0.15	1.25***	0.15	1.23***	0.15
Adjacent-nonmetro (mean)	-1.19***	0.12	-1.20***	0.12	-1.21***	0.12
Adjacent-nonmetro (std. dev.)	0.47**	0.19	0.53**	0.18	0.54**	0.18
Non-Adjacent-nonmetro (mean)	-1.57***	0.14	-1.57***	0.14	-1.56***	0.14
Non-Adjacent-nonmetro (std. dev.)	0.97***	0.16	0.97***	0.16	0.96***	0.16
Tenure (mean)	0.26***	0.04	0.26***	0.04	0.26***	0.04
Tenure (std. dev.)	0.15***	0.02	0.14***	0.02	0.15***	0.02
Tenure ^2 /100 (mean)	3.31***	0.37	3.41***	0.39	3.41***	0.39
Tenure ^2 /100 (std. dev.)	2.08***	0.18	2.13***	0.19	2.14***	0.19
Distance home (mean)	-1.04***	0.04	-1.04***	0.04	-1.04***	0.04
Distance home (std. dev.)	0.88***	0.03	0.87***	0.03	0.87***	0.03
Ln L		-7795.48		-7783.94		-7782.55
Likelihood Ratio				25.85		2.77

Notes: *** = significant at the 1-% level; ** = significant at the 5-% level; *= significant at the 10-% level. Model estimated using maximum simulated likelihood using code written by Kenneth Train and Paul Ruud, available at http://elsa.berkeley.edu/~train/software.html. Number of iterations = 500. Number of alternatives =50. Sample size is 8,544. See text for details.

Table 3.4. Own Elasticities of Choice Probabilities with Respect to Selected County Characteristics

County Attribute	Age 25	Age 30	Age 35	Age 40
Per Capita Income				
Rural	0.287	0.415	0.543	0.643
	(0.056)	(0.077)	(0.098)	(0.117)
Urban	0.340	0.503	0.665	0.763
	(0.062)	-0.098	(0.138)	(0.169)
All	0.305	0.446	0.585	0.697
	(0.063)	(0.095)	(0.128)	(0.154)
College Share				
Rural	0.409	0.497	0.520	0.562
	(0.164)	(0.194)	(0.201)	(0.219)
Urban	0.620	0.747	0.800	0.809
	(0.278)	(0.328)	(0.351)	(0.375)
All	0.479	0.583	0.617	0.673
	(0.231)	(0.276)	(0.295)	(0.324)
Amenities				
Rural	0.069	0.063	0.055	0.042
	(0.350)	(0.356)	(0.345)	(0.342)
Urban	0.128	0.129	0.119	0.100
	(0.428)	(0.434)	(0.420)	(0.403)
All	0.088	0.086	0.077	0.068
	(0.378)	(0.386)	(0.373)	(0.372)
Employment Growth				
Rural	-0.046	-0.025	-0.052	-0.046
	(0.064)	(0.051)	(0.061)	(0.047)
Urban	-0.079	-0.065	-0.038	-0.071
	(0.069)	(0.062)	(0.058)	(0.068)
All	-0.057	-0.039	-0.078	-0.057
	(0.068)	(0.058)	(0.060)	(0.059)

Notes: Estimated standard errors in parentheses.

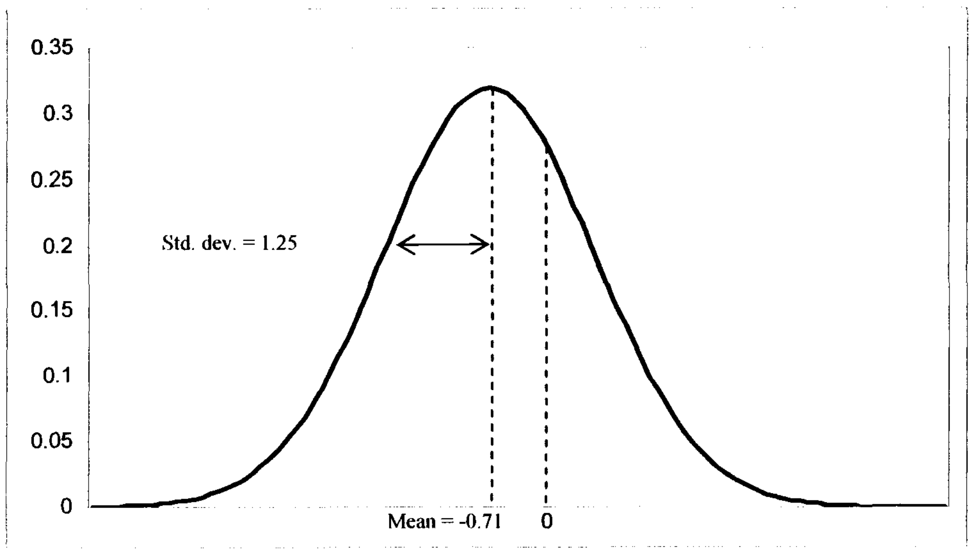


Figure 3.1. Distribution of the Coefficient of Rural

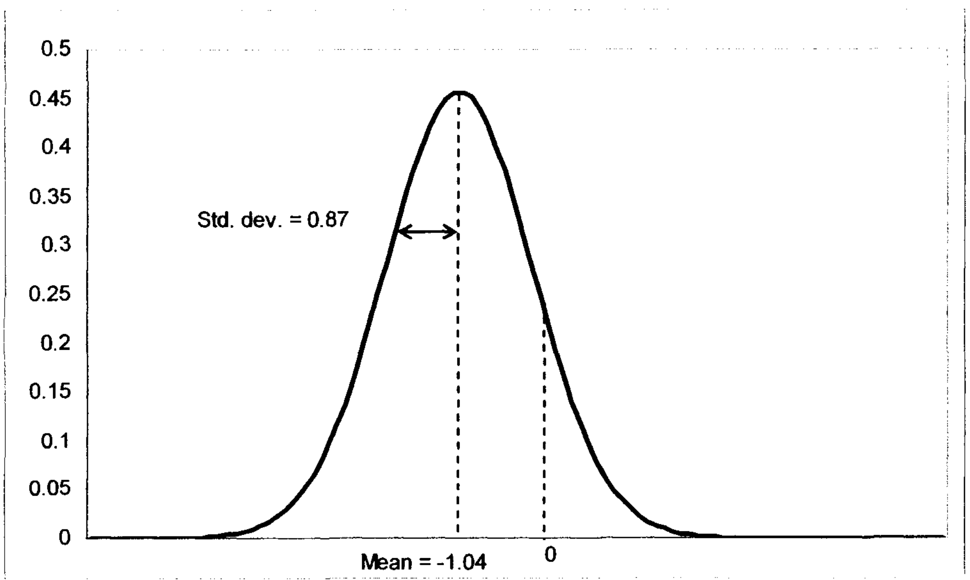
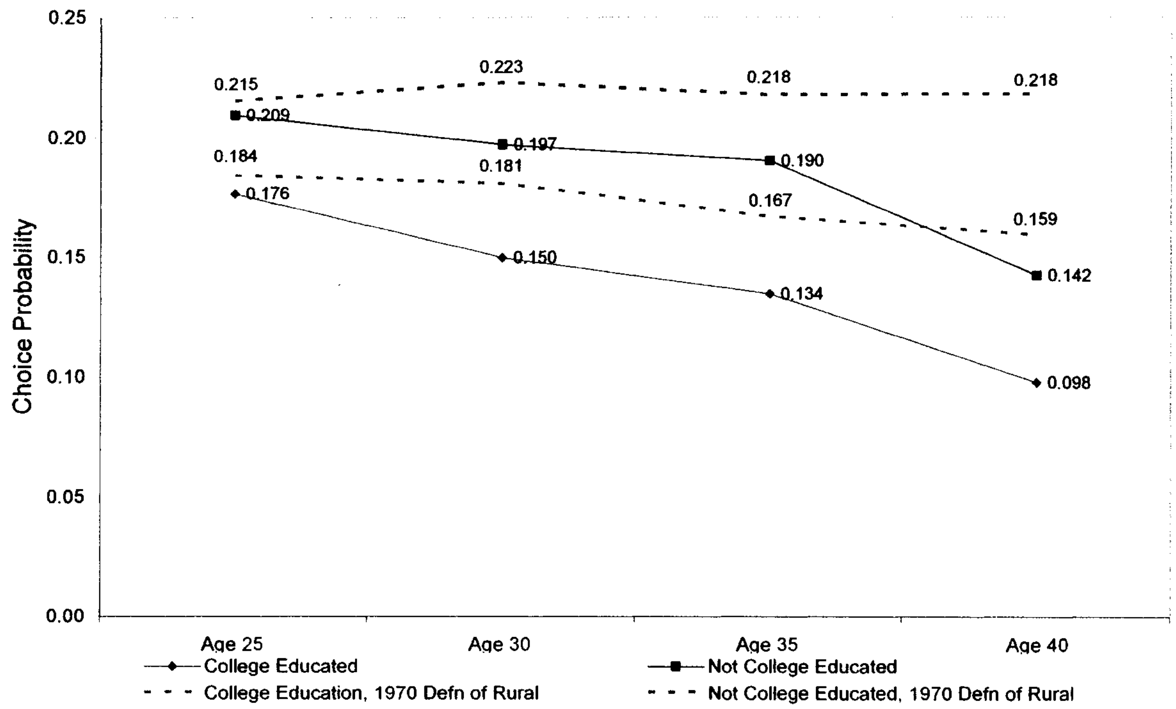


Figure 3.2. Distribution of the Coefficient of Distance Home



Notes: Choice probabilities are calculated using the parameter estimates from Model B and are averaged across individuals for each county. Choice of rural is the sum of the estimated choice probabilities for all rural counties.

Figure 3.3. Probability of Choosing Rural By Age and Education Level

Table 3A.1. Comparison of Results Using 10, 20 and 50 alternatives

Variable	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Amenities	0.08***	0.01	0.13***	0.01	0.12***	0.01
College Share	0.06***	0.00	0.05***	0.01	0.03***	0.00
Rent	-0.13***	0.02	-0.45***	0.02	0.05**	0.03
Tenure dummy	-1.39***	0.08	-3.16***	0.13	-2.07***	0.11
College Educ * Amenities	0.10***	0.03	0.06	0.04	0.05	0.03
College Educ * College Share	0.02*	0.01	0.02*	0.01	0.03***	0.01
Average Per Capita Income	-0.07***	0.01	0.07***	0.01	0.03***	0.01
Employment Growth	-2.15**	0.95	0.20***	0.01	0.19***	0.01
Distance (mean)	-0.67***	0.02	-0.76***	0.02	-0.77***	0.02
Distance (std dev)	0.38***	0.02	0.51***	0.03	0.52***	0.02
Rural (mean)	-1.11***	0.11	-1.99***	0.16	-1.72***	0.15
Rural (std dev)	-0.04	0.63	0.17	0.51	1.04***	0.15
Adjacent-nonmetro (mean)	-0.93***	0.10	-0.99***	0.11	-1.16***	0.12
Adjacent-nonmetro (std dev)	-0.03	0.69	-0.03	0.61	0.79***	0.16
Non-Adjacent-nonmetro (mean)	-1.24***	0.10	-1.30***	0.11	-1.31***	0.13
Non-Adjacent-nonmetro (std dev)	0.00	0.70	0.04	0.87	-0.49**	0.22
Tenure (mean)	0.21***	0.02	0.19***	0.05	0.27***	0.04
Tenure (std dev)	0.01	0.04	-0.04	0.05	-0.09***	0.02
Tenure ^2 /100 (mean)	0.06	0.14	3.51***	0.46	2.59***	0.39
Tenure ^2 /100 (std dev)	0.57***	0.08	-1.71***	0.18	1.61***	0.18
College Educ * Tenure (mean)	-0.14***	0.02	-0.16***	0.03	-0.11***	0.03
College Educ * Tenure (std dev)	0.09	0.07	0.05	0.16	0.11*	0.07
Rural Experience * Rural (mean)	0.15***	0.01	-2.64**	1.30	-6.56***	1.18
Rural Experience * Rural (stddev)	-0.06***	0.02	-0.67	12.49	-12.76***	1.77
Ln L		-6269.4		-5723.0		-8644.5

Notes: *** = significant at the 1-% level; ** = significant at the 5-% level; *= significant at the 10-% level. Model estimated using maximum simulated likelihood using code written by Kenneth Train and Paul Ruud, available at http://elsa.berkeley.edu/~train/software.html. Number of iterations = 500.

General Conclusion

This dissertation, comprised of three essays, explores a number issues pertaining to economic growth in rural regions of United States. The first essay demonstrates that the way in which researchers define rural matters for measuring growth. It also has implications for understanding which factors are important for generating economic growth in rural areas. Defining the sample of rural places at the end of the period of analysis excludes the most successful places, those that grew so much as to lose their rural status. In addition, analyzing growth over short periods yields different results when compared with analysis over longer time frames. The second essay uses a difference-in-differences approach to measure the economic and social impacts of growth in the meat packing and processing industry in the Midwestern United States. The results indicate that growth in this industry spurs total employment growth, but on average, deters employment growth in other sectors and slows wage growth at the county level. The analysis does not provide evidence that growth in the meat packing and processing industry contributes to growth in crime rates or government spending. This analysis could be considered a worst case scenario of industrial recruitment. The findings imply that gaining this industry might not induce the large negative economic impacts suggested by previous research, but the associated positive impacts cited by supporters are not a foregone conclusion either. The final essay examines the issue of brain drain, or the out-migration of college educated youth from rural areas. It employs a mixed logit model to analyze the effects of college education and location specific capital on the probability individuals choose to reside in rural locations. The findings suggest that individuals with a college education are less likely to opt for rural residences. The mixed logit model allows for taste variation in the location choice decision, representing the notion that individuals' preferences for particular locations may vary for reasons unobserved by the researcher. This analysis provides evidence of taste variation in the population with respect to the rural character of locations. Further research aimed at explaining this variation could provide valuable information to rural policy makers concerned with attracting educated labor to their communities.

The research presented in this dissertation represents only a small step toward a more complete understanding of rural economic growth. However, these are important issues, affecting the lives of real people. It is hoped that the findings discussed here will serve to inform the development of effective polices for improving both the vitality of rural communities and the lives of their residents.

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