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

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Abstract

Beale codes are an important tool for examining rural urban differences in socioeconomic trends. 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. 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. Most strikingly, the estimated impact of human capital on rural growth is completely reversed when the sample is based on end-of-period rather than start-of-period rural status. 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.

Beale codes, or rural-urban continuum codes, are an important tool for researchers interested in examining differences in socioeconomic outcomes between metropolitan and non-metropolitan areas. However, these codes change over time as county population increases or decreases. The most successful rural counties in 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. 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 of human capital endowments reverse 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 proposes government provision of venture capital and tax incentives for individuals and businesses to locate in rural areas 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.

1. DEFINING RURAL STATUS

Rural-urban continuum codes classify counties into categories based on population data from the U.S. census and, for non-metropolitan 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/non-metro 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,[2] definitional changes have altered how counties are classified. 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. Table 1 provides a description of the coding system. While the Beale codes are typically referred to by the year in which they were released (1974, 1983, 1993, 2003), for the sake of clarity, we will reference the codes by the Census year upon which they are based (1970, 1980, 1990, 2000).

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.

Table 2 shows the number of counties by 1970 and 2000 rural-urban continuum codes. Each row corresponds to a 2000 rural-urban 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 counties classified as metro 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 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. becoming more urban). 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 code).

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.[3] Of the 857 counties categorized as rural in 1970 (types 8 or 9), 368 or 43% moved up in the continuum. About one-third of the 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 non-metropolitan 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 rural 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 non-metropolitan and metropolitan population

growth rates over time, using county level data. Their analysis revealed significant differences in the non-metropolitan growth rate depending upon the method and definitions applied. For example, they reported non-metropolitan 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 non-metropolitan growth rates varied from a 10.9 % increase to a 13.2 % decline. Curiously, 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 rural 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. A number of articles appearing in leading academic journals with a rural development focus since 2002 examine metro/non-metro 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/non-metro, yet in most the timing of the classification scheme is not discussed. Of nineteen articles identified, four used the appropriate

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/urban/rural status reported by the government, they will 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 non-metropolitan. 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 or metropolitan areas without changing residence.[4] These seemingly minor points can lead to very misleading conclusions about changes in rural areas. The U.S. Census reported a decrease in the rural population from 1990 to 2000, the first decrease in the rural population in the history of the United States. However, the decrease was due to counties changing from rural to non-rural designations rather than a population decrease in counties designated as rural in 1990.

The biases that can occur by inappropriately using end-of-period codes to designate rural/nonmetropolitan/metropolitan status are large. As initially shown by Hines, Brown and Zimmer, population growth in counties that changed from nonmetropolitan to metropolitan was significantly higher than growth in the counties that did not change classification, so the use of end-of-period designation significantly biases downward measures of rural population growth. Other commonly used measures of economic progress, employment growth and real income growth, are also are biased against rural progress when end-of-period designations are used.

Population Growth

Table 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, using the 2000 classification scheme understates population growth for the group. 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 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 non-metropolitan, 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 non-metropolitan or rural in 1970, with about one-fourth (103) classified as rural. Of this set of fastest growing counties, two-thirds changed Beale code designation, moving up in the classification scheme. Proportionately more of the non-metropolitan (84%) and rural (80%) counties in this set moved up in the continuum. More than half of the rural counties in this group (55 of 103) lost their rural status by 2000. Likewise, 69 of the 128 non-metropolitan counties had become metropolitan by 2000.

Employment Growth

Table 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 4 is similar to table 3.

These data display a pattern similar to that in table 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 relatively slower. 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 largest non-metropolitan counties (types 4 and 5) all experienced employment growth at or above the national average. In contrast, employment growth in the smaller non-metropolitan and rural counties lagged behind the national average. When the 1970 codes are used, however, a

somewhat different picture emerges. Non-adjacent non-metropolitan 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 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 (types 8 and 9) in 1970, but classified as non-metropolitan or metropolitan in 2000 experienced average income growth well above the national average. 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, income growth in these rural counties is shown instead to be 182% and 112%.[5]

Table 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.

For six of the nine county designations, the direction of the bias is consistent across the 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 counties. Most noticeably, growth is consistently inflated in type 5 counties, the largest non-metropolitan, non-adjacent counties, when the 2000 designations are used.

The implication of table 6 is that rural growth is consistently understated relative to metropolitan growth in official statistics that allow rural designations to change. The biases are large. Researchers or policy makers who are not careful to correct for the biases can be seriously misled about the true growth of rural, nonmetropolitan and metropolitan areas.

2. REGRESSION ANALYSIS OF THE DETERMINANTS OF COUNTY GROWTH

In addition to creating problems in reporting and analyzing trends for metropolitan, non-metropolitan and rural counties, changing Beale code classifications also have implications for assessing the determinants of growth. To illustrate, we regressed the rural county growth rates described above on human capital measures, policy variables, and environmental factors commonly used in this literature[6]. These are defined in Table 7. In each case, we defined the sample of rural counties (codes 8 and 9) in two ways. The first, based on the 1970 Beale code

definitions, results in a sample of 847 rural counties. The second, derived from the 2000 codes, produces a sample of 654 rural counties. Table 8 reports the regression results for the two samples. 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.[7] 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.

There are substantial differences in coefficients between the two samples. 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. Therefore, conclusions regarding the effect of the various factors on rural growth are subject to selection bias based on the rural designation used.

The most striking is the change in the sign and significance of the coefficients on $College_{70}$, and $HighSchool_{70}$, our measures of the amount of human capital available in the county in 1970. In the population growth equation, both coefficients are large, positive and jointly significant using the 1970 rural designations. The effects disappear when the 2000 designations are used. In both the employment and income growth equations, the 1970 designations suggest that higher proportions of college graduates in 1970 strongly raise growth while use of the 2000 designations finds a negative effect of college graduates on employment and income growth. An analysis that selects rural counties on the basis of end-of-period

designations might easily conclude that the level of human capital does not matter for population and employment growth, and is negatively related to income growth.

Another important difference between the two sets of regressions is the estimated effect of local fiscal policies on growth. The coefficients on taxes per worker are not measured precisely, however, in the 1970 sample they are positive in the population and employment growth regressions, whereas using the 2000 sample, signs are reversed. Higher expenditures raise population, employment and income growth significantly using either rural sample, but the coefficients shrink in magnitude using the 2000 sample.

Conclusions about convergence also change depending on the sample of counties analyzed. Counties with higher initial levels of population have faster population growth using the 1970 Beale code rural sample, but the coefficient shrinks in sign and significance using the 2000 sample. A similar pattern holds for the income growth equations, except that there is evidence of convergence in income growth. Counties with higher start of period income levels have slower subsequent income growth. Although the estimates are not precise, the 1970 sample provides evidence of divergence in employment growth, whereas the 2000 sample suggests convergence. As with the human capital measures, using beginning-of-period rural designations results in conclusions very different from those reached when end-of-period designations are applied.

This problem of sample selection 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.[8] We have demonstrated an analogous situation in which sorting can 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.

Some conclusions about the data do not change drastically as a result of changing Beale code classifications. The various amenities measures generally have consistent signs and significance across the two samples, although not always in directions consistent with presumptions. Areas with more sunny days, varying typography, water, and warmer Januaries have faster growth, as do areas with warmer Julys and more humidity.

A common result is that the coefficients using the 2000 rural designations are smaller in magnitude than those using the 1970 rural designations. The use of end-of-period designations lessens the heterogeneity in growth across counties, biasing the coefficients toward zero.

Regression Analysis by Decade

The regression results in table 8 showed that income growth tends to converge over time while population growth tends to diverge across counties. This raises an interesting question regarding the appropriate length of time for studying growth. Of the recent journal articles examining metro/non-metro/rural 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 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. Consistent with the table 8 results, 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 1980s and 0.67 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 essentially no correlation between the 1970s and 1980s, and only a weak relationship between the 1980s and 1990s. However, the longer term correlation is stronger than the shorter term. The correlations suggest that population growth from one decade to the next is most consistent, but that employment and income growth in any one decade may not be indicative of growth in other decades. When the 2000 designations for rural status are used to define the set of rural counties, the correlations between decades become even weaker, because the top performing counties are selected out of the sample.

Table 9 suggests that regression results may vary by the length of time over which growth is measured, particularly for employment and income growth. Table 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[9].

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 regression results for growth from 1970 to 1980. The second column reports the results for growth from 1980 to 1990; the third column shows the results for growth from 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.

The population growth equation is the most consistent across decades. Nine of twelve coefficients retain sign and significance across all three decades. Employment growth is considerably less consistent with only three of twelve coefficients retaining sign and significance. The population growth equations have similar goodness of fit measures in the decade-by-decade growth equations as in the 30-year growth equations in table 8, while for the employment growth regressions, the goodness-of-fit measures fall by one-third or more. There is virtually no consistency across the decade-by-decade income growth equations and the goodness-of-fit is a fraction of that in table 8. Clearly, a one decade period will not yield reliable implications for income growth across counties.

Even for the more reliable employment and population growth equations, 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 positive on population growth and negative on employment growth, but insignificant in either case. In the 1980s, neither variable seems to matter much: they are small and, expect for expenditures in the employment growth equation, insignificant. By the 1990s, some of 1970 results have reversed themselves. Government expenditures per capita lower population growth, while taxes per

capita have a positive but imprecisely estimated effect on employment growth. The joint test of coefficient stability across decades is rejected in all three sets of equations.

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 rural growth.

3. CONCLUSION

This analysis illustrates the bias in using Beale codes to define rural and urban status. Using end-of-period designations to define rural significantly understates the economic performance of rural counties over the past three decades. Furthermore, the choice of Beale code vintage can alter conclusions about which factors affect growth. We also find that the choice of time frame for the analysis may alter the findings. We do not find strong evidence among rural counties that growth begets growth, but rather that the performance tends to vary by decade.

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 consistently positive and significant across specifications. But these are factors not easily altered by policy. Conclusions regarding the roles of human capital stock and tax and expenditure levels vary according to the specification. In particular, relying on end-of-period rural designations greatly understates or even reverses the evidence that human capital is critically important to rural growth.

Beale codes are an important tool in the analysis of rural-urban differentials; however, our analysis suggests that caution is warranted in their use for longitudinal analysis, particularly analysis of growth. When one defines rural status has important implications for the outcome of an analysis. In order to avoid biased estimates and subsequent flawed interpretations of the data

associated with the fact that the top performers are selected out over time, researchers should define rural-urban classification at the beginning of the period of the analysis.

This is more than just a statistical curiosity. The exaggerated decline in rural population has been used to justify numerous government programs designed to stem the tide of the rural decline. Even worse, studies try to identify "best practices" based on the fastest growing of the remaining rural counties, ignoring that the fastest growing are the 30% of rural counties no longer designated as rural. This is not to suggest that it is never appropriate to apply the most recent classification scheme in research. It depends on the particular question being addressed. Yet, when the focus is long term economic growth in rural or non-metropolitan areas, how and when one defines rural status is clearly important.

Endnotes

[1] Quoting the web site of Senator Byron L. Doran. The news release supporting the New Homestead Act contend 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] 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.

[4] 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.

[5] 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).

[6] 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 $dy_t = F(y_{t-1}, h_{t-1}, x_{t-1}....)$ 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).

[7] 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 ion coefficients between the two sets of counties.

[8] 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."

[9] 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.

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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, pp. 430-452.	1995 Cycle of the National Survey of Family Growth	1965 -1995	1990 classifications	A
Allen, B.L., "Race and Gender Inequality in Homeownership: Does Place Make a Difference?" *Rural Sociology* 67(4), 2002, pp. 603-621.	IPUMS	1970, 1980, 1990	Unclear	A
Goe, W. Richard, "Factors Associated with the Development of Nonmetropolitan Growth Nodes in Producer Services Industries, 1980-1990," *Rural Sociology* 678(3), 2002, pp. 416-441.	Economic Census, CBP	1980-1990	1990 classifications	A, B
Goetz S.J. & Rupasingha A. "The New Rural Economy: High–Tech Firm Clustering: Implications for Rural Areas", AJAE December 2002, vol. 84, no. 5, pp. 1229-1236(8)	CBP	1990-1999	Unclear	A
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*, Vol. 44, No. 3, 2004, p. 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.	A
Huang T-L., Orazem P.F & Wohlgemuth D., "Rural Population Growth, 1950–1990: The Roles of Human Capital, Industry Structure, and Government Policy," AJAE August 2002, vol. 84, no. 3, pp. 615-627(13)	Census, other various	1950-1990	Applied 1980 definitions and criteria to approximate 1950 classifications	
Hunter, L. & J. Sutton, "Examining the Assoc. B/w Hazardous Waste Facilities and Rural 'Brain Drain'", *Rural Sociology* 69(2), 2004, pp. 197-212.	US Census , 85-90 migration data	1985-1990	Unclear, 2358 NM counties implies the use of 1980 classifications	A, B
Leichenko & Silva, "International Trade, Employment and Earnings: Evidence from US Rural Counties", *Regional Studies*, Vol. 38.4, pp. 355–374, June 2004	Census (LRD), other various	1972-1995	Unclear	A
Martin, Richard W., "Spatial Mismatch and the Structure of American Metropolitan Areas, 1970-2000, *J. of Regional Science*, Vol. 44, No. 3, 2004, p. 467-488	Census, CBP	1970-2000	2000 MSA designations (729 counties belonging to 179 MSAs)	A

McLaughlin, D., "Changing Income Inequality in Nonmetropolitan Counties, 1980 to 1990," *Rural Sociology* 67(4), 2002, pp. 512-533.	Census	1980-1990	Unclear, 2257 NM counties implies the use of 1990 classifications	A, B
Mills, B and Hazarika, "Do Single Mothers Face Greater Constraints to Work Force Participation in Non-Metropolitan Areas?" AJAE, 85(1), Feb 2003:143-161.	CPS	1993-1999	Unclear	A, B
Pagoulatus, S., S. Goetz, D. Debertin, & T. Johannson, "Interactions Between Economic Growth and Environmental Quality in US Counties, 1987-1995 *Growth and Change,* February 2004, vol. 35, iss. 1, pp. 90-108(19)	USA Counties	1987-1995	Unclear, 23% of counties designated as metro which implies the use of 1980 classifications	A, B
Renkow, M. "Employment Growth, Worker Mobility, and Rural Economic Development," AJAE, May 2003 85(2): 503-513.	Census, BEA	'80-'90	1980 classifications	
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* Winter 2002, vol. 33, no. 1, pp. 115-132(18)	Ag Census, Census	1978-1997	1990 classifications	A
Slack, T. & L. Jensen, "Race, Ethnicity and Underemployment in Nonmetropolitan America: A 30-Year Profile," *Rural Sociology* 67(2), 2002, pp. 208-237.	CPS	1968-1998	Unclear	A
Snyder, A., S. Brown & E. Condo, "Residential Differences in Family Formation: The Significance of Cohabitation," *Rural Sociology* 69(2), 2004, pp. 235-260.	1995 Cycle of the National Survey of Family Growth	1965 -1995? (retrospective marital, fertility histories	1990 classifications	A
Snyder A. and D. McLaughlin, "Female-Headed Families and Poverty in Rural America," *Rural Sociology* 69(1), 2004, pp. 127-149.	CPS	1980, 1990, 2000	Unclear	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, pp. 231-252.	Ag Census	1982, 1987, 1992, 1997	1990 classifications	A
Thomas, J. and F. Hovell, "Metropolitan Proximity and US Agricultural Productivity 1978-1997," *Rural Sociology* 68(3), 2003, pp. 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	A

[a]Possible bias due to sample selection where A indicates classification of rural/nonmetropolitan/metropolitan not at the beginning of the analysis or timing of classification is uncertain, but likely end-of-period or changing over time, B indicates short time period of analysis.

TABLE 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 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 3: Average Population 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	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 4: Average Employment 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	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 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 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	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)
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 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	11.25	1.39
$Linc_{70}$	Natural log of county income (in 1970 dollars)	Bureau of Economic Analysis	7.76	0.68
Typography	Typography scale	ERS	10.02	6.75
Water	Percent water area	ERS	3.55	0.91
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	34.98	11.78
$College_{70}$	Proportion of county population with 4 or more years of college	U.S. Census	5.72	2.84
$Taxperemp_{70}$	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 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	-2.521***	-1.008***	2.08†	-4.151***	-1.838	1.05	0.846	0.695	0.09
	(4.25)	(2.82)		(3.88)	(2.58)		(0.83)	(1.08)	
$Lpop_{70}$	0.154***	0.039	4.52†						
	(3.81)	(1.60)							
$Lemp_{70}$				0.083	-0.049	3.19†			
				(1.16)	(1.02)				
$Linc_{70}$							-0.085**	-0.024	2.51†
							(2.43)	(1.10)	
Typography	0.091***	0.083***	1.82	0.228***	0.165***	1.84	0.237***	0.167***	1.95
	(3.07)	(4.71)		(4.46)	(4.78)		(4.10)	(4.58)	
Water	0.218***	0.125***	2.60†	0.290***	0.167***	2.29†	0.382***	0.245***	0.80
	(8.13)	(8.08)		(6.28)	(5.56)		(7.35)	(7.64)	
Jantemp	0.263***	0.133***	1.08	0.173**	0.105***	1.75	0.241***	0.155***	0.63
	(8.04)	(6.75)		(3.05)	(2.76)		(3.76)	(3.82)	
Sun	0.174***	0.041**	5.70†	0.203***	0.061	3.54†	0.238***	0.094**	3.60†
	(5.53)	(2.11)		(3.78)	(1.64)		(3.94)	(2.42)	
Julytemp	0.343***	0.180***	4.79†	0.424***	0.255***	2.58†	0.541***	0.320***	3.25†
	(10.56)	(9.38)		(7.57)	(6.83)		(8.55)	(8.16)	
Humid	0.105***	0.060***	1.33	0.078	0.075**	1.48	0.028***	0.008	0.24
	(3.24)	(3.03)		(1.42)	(2.01)		(0.46)	(0.21)	
$HighSchool_{70}$	0.007**	-0.001	3.84†	-0.007	-0.002	0.51	-0.017***	-0.014***	1.17
	(2.10)	(0.38)		(1.10)	(0.52)		(2.60)	(3.44)	
$College_{70}$	0.007	0.001	0.95	0.049**	-0.025*	3.82†	0.066***	-0.025*	3.85†
	(0.63)	(0.17)		(2.49)	(1.78)		(2.98)	(1.68)	
$Taxperemp_{70}$	0.016	-0.010	0.45	0.055	-0.043	1.09	-0.045	-0.113	2.78†
	(0.23)	(0.24)		(0.46)	(0.54)		(0.34)	(1.37)	
$Expperemp_{70}$	0.174**	0.137***	1.14	0.568***	0.468**	0.03	0.287*	0.277***	0.96
	(2.17)	(2.87)		(4.13)	(5.10)		(1.84)	(2.83)	
R-square	0.3454	0.3816		0.2664	0.2903		0.2968	0.3899	
N	847	654		847	654		847	654	
Joint F			24.50†			14.45†			21.59†

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.

TABLE 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	0.66	0.53	0.28	0.17	-0.03	-0.29
80s & 90s	0.67	0.59	0.32	0.30	0.22	0.06
70s & 90s	0.62	0.56	0.20	0.19	0.52	0.44

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 10: Comparison of Regression Results Across Decades

	Population Growth				Employment Growth				Income Growth			
	1970s	1980s	1990s		1970s	1980s	1990s		1970s	1980s	1990s	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	-1.015***	-0.630***	-0.563***	2.79	-1.479***	-0.527**	-0.140	4.36†	0.336	-0.453**	-0.240	3.50†
	(5.80)	(5.03)	(4.07)		(4.09)	(2.31)	(0.36)		(1.30)	(2.16)	(1.31)	
$Lpop_{t-10}$	0.063***	0.059***	0.058***	0.08								
	(5.26)	(7.97)	(7.39)									
$Lemp_{t-10}$					0.027	0.038***	-0.006	1.22				
					(1.14)	(2.85)	(0.25)					
$Linc_{t-10}$									-0.002	0.036***	0.025***	7.48†
									(0.19)	(5.70)	(4.68)	
Typography	0.048***	0.010*	0.017***	8.07†	0.088***	0.029***	0.019	6.08†	-0.008	-0.001	-0.004	0.02
	(5.43)	(1.71)	(2.82)		(5.10)	(2.82)	(1.09)		(0.52)	(0.55)	(0.43)	
Water	0.060***	0.031***	0.037***	5.60†	0.070***	0.034***	0.058***	1.72	-0.015	0.008	-0.006	1.14
	(7.52)	(6.15)	(6.75)		(4.49)	(3.73)	(3.73)		(1.15)	(0.79)	(0.76)	
Jantemp	0.082***	0.058***	0.051***	4.53†	0.053***	0.038***	0.015	1.35	0.010	0.008	-0.014	1.11
	(8.42)	(9.92)	(8.18)		(2.77)	(3.60)	(0.88)		(0.59)	(0.71)	(1.50)	
Sun	0.023**	0.033***	0.035***	0.69	0.030	0.019*	0.047**	0.69	-0.041***	-0.002	-0.017	2.50
	(2.50)	(5.40)	(5.28)		(1.64)	(1.71)	(2.49)		(2.70)	(0.21)	(1.64)	
Julytemp	0.085***	0.051***	0.083***	5.73†	0.076***	0.066***	0.097***	0.82	0.001	0.003	-0.005	0.10
	(8.88)	(8.34)	(12.30)		(4.02)	(5.89)	(5.11)		(0.06)	(0.28)	(0.50)	
Humid	0.040***	0.021***	0.017**	2.70	0.034*	0.009	-0.018	2.50	0.033**	-0.028**	0.003	5.90†
	(4.20)	(3.36)	(2.53)		(1.83)	(0.84)	(0.97)		(2.15)	(2.43)	(0.29)	
$HighSchool_{t-10}$	0.001	0.002**	0.002***	0.19	-0.002	0.000	-0.001	0.21	0.003	0.003***	0.000	1.10
	(1.38)	(2.53)	(2.77)		(1.05)	(0.42)	(0.61)		(1.52)	(2.78)	(0.28)	
$College_{t-10}$	0.007**	0.002	0.002	1.33	0.024***	0.003	0.012***	4.13†	0.002	-0.001	0.001	0.09
	(1.99)	(1.53)	(0.99)		(3.58)	(1.24)	(2.75)		(0.29)	(0.19)	(0.36)	
$Taxperemp_{t-10}$	0.016	0.005	0.008	0.15	-0.029	-0.016	0.019	0.59	0.029	0.021	0.050***	0.44
	(0.78)	(0.51)	(0.68)		(0.70)	(0.87)	(0.56)		(0.86)	(1.13)	(2.78)	
$Expperemp_{t-10}$	0.064***	-0.002	-0.005	4.54†	0.235***	0.005**	0.023	8.42†	-0.029	0.006	-0.016	0.32
	(2.70)	(0.13)	(0.35)		(5.04)	(2.12)	(0.56)		(0.72)	(0.23)	(0.69)	
R-square	0.3611	0.3493	0.4116		0.2077	0.1773	0.1189		0.0411	0.0647	0.0674	
N	846	771	767		846	771	767		846	771	767	
Joint-F				17.81†				7.49†				3.69†

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.