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A Multivariate Analysis of Changes in Population from 2000 to 2010 at the County-Level in the U.S.

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Introduction

Results from the 2010 Census of Population confirmed the continuation of a number of long-standing demographic trends occurring in the U.S. The population is getting older, the population center continues to shift to the South and the West and the population is becoming more urbanized than in the past. Changes in population growth rates impact states and counties in various ways and pose new challenges for both growing and declining regions. These impacts range from the provision of adequate health care and shifting requirements for the physical infrastructure to impacts on state and local revenue collections and changes in occupational skills required of a local workforce.

Population change results from a combination of variations in the natural rate of increase (births over deaths) as well as from fluctuations in domestic and international migration streams when persons move across political jurisdictions. Therefore, governmental officials and community leaders who are charged with examining the impacts of population change in a local area need to understand the factors which underlie the overall change in population which are more comprehensive than the factors behind migration flows which have been the focus of considerable research investigation in recent decades.

In this study we examine numerous influences on changes in county-level populations over the period covered by the 2000 and 2010 Censuses of Population in order to identify sources of changes in local populations. Over this ten year period, the Bureau of the Census reported that overall population in the U.S. increased by 9.7 percent. However, the change in the population ages 18 to 44 increased by a much smaller 0.6 percent, while the population of the largely-baby boomer cohort between the ages 45 to 64 increased 31.5 percent, and the population 65 and older increased by 15.1 percent (2010 Census Summary File 1).

During this decade, all states increased in population except for Michigan; however only about two-thirds of the nation's 3,143 counties gained in overall population over the ten years while the remaining third are dying off as younger adults are moving out to seek jobs in other locations. Our analysis is confined to 3,107 counties within the 48 contiguous states, and is designed to identify characteristics that separate the rapidly-growing counties from those which did not grow as quickly and those counties which actually lost population over this ten-year period. In addition, we extend the analysis by introducing cluster-based techniques as a means of increasing our understanding of the effects of the predictor variables on population change. Through cluster analysis we were able to classify these counties into six broad groups as a means of categorizing and summarizing our findings.

In an analysis of the ten years preceding the time frame for this study, McGranahan and Beale (2002) identified three characteristics that distinguished population-losing counties from those gaining in population. The counties where population growth lagged were located further away from metro regions, had low-population densities and contained few natural amenities such as favorable climate, water or topography. Although economic models have postulated that locations with high poverty rates should also be associated with population-losing regions, McGranahan and Beale did not find that to be the case between 1990 and 2000. The results of our analysis for the subsequent decade from 2000 to 2010 are consistent with their findings. Therefore, while positive amounts of natural amenities and proximity to metro areas continue to serve as favorable indicators of population growth, the relative poverty level within each county was not significant in our original model, and was subsequently dropped from our model.

Traditionally, we can assume that migration flows, and thus also population change, are influenced by a combination of economic advantages including high levels of employment in the extractive industries, manufacturing, or government (including military bases and universities) along with a favorable climate and high levels of natural amenities. Ullman (1954) was an early pioneer in establishing the role of amenities in the migration decision when he noted that "pleasant living conditions …are becoming the sparks that generate significant population increase." The elevation of the role of the environment in the migration decision has become more persistent as changes in demographic and income levels have heightened the interest in recreational tourism, and have afforded increased opportunities for more persons to purchase retirement and second homes in desirable locations.

A lengthy and expanding list of publications confirms the increasing importance of natural amenities and population change. Brown, et al. (2011) employed a path-dependent process to examine the variability in net-inmigration rates of persons between the ages of 60 and 74 in the nonmetro counties of the U.S. They conclude that counties with high levels of natural amenities that develop recreation and tourism infrastructure are enhancing their ability to serve as prime destination areas, and once the migration streams become established they become self-perpetuating. Ulrich (1986) found evidence that American and European populations preferred open spaces in a nature-based environment, especially when a variety of topographic features and trees and other vegetation exist. This was later confirmed in a simultaneous equation model by McGranahan (2008) who found that landscape features exerted a direct influence on migration.

Poudyal et al. (2008) documented the substantial impacts of "rural and biologically rich counties.... and other man-modified natural and recreational attractions" in increasing the number of retirees into an area. In addition, Gude et al. (2006) examined the conversion of the natural ecosystem as a result of the rapid growth in rural home construction in the Greater Yellowstone region, and Waltert and Schläpfer (2010) found that migrants are as attracted by the existence of amenities as they are by low taxes.

Although amenity-based migration has been observed in numerous locations across the U.S., the shift in trends within the Mountain West region of the country appears to be more pronounced than in many other areas. Vias (1999) and Shumway and Otterstrom (2001) have specifically pointed to the evolving nature of the regional economy in these mountain states where dependence on the extractive sectors – mining, logging, ranching and farming – has been partly replaced by a dependence on environmental amenities as well as the growth of service industries to support the new lifestyle that has emerged.

Vias (1999) also attributes migration patterns to changing residential preferences which place increased emphasis on 'environmental amenities and rural lifestyles' in the decision to relocate as opposed to merely looking at economic opportunities in these localities.

In addition, numerous studies confirm that location-specific amenities will influence the migration decision as well (McGranahan 1999; Deller et al., 2001; Green 2001; Gunderson and Ng 2006.)

While amenity factors have become increasingly important, economic opportunity has long been the dominant force behind changes in the movement of population. A lengthy history of articles points to favorable economic conditions as an indicator which attracts new residents into local areas (Muth 1971; Greenwood 1975, 1985; Partridge and Rickman 2006).

Urban proximity may also play an important role in migration flows. Johnson and Stewart (2005) found that second-home owners from nearby metropolitan areas who were attracted to areas in southeastern Wisconsin which contain high levels of recreation-based amenities were motivated to permanently move to these locations later in life.

Furthermore, the combination of economic and amenity-based considerations which might be captured in variables designed to measure the overall quality-of-life in a region, has been confirmed in many studies including Cushing 1987; Cebula and Payne 2005, and Roback 1982. In a follow-up to Roback's work, Blanchflower and Oswald (1994) also found that migrants are sometimes willing to forego better employment opportunities for higher-amenity conditions. On the opposite end, Cebula and Alexander (2006) found that outmigration is in part a result of negative environments in an area, specifically, the presence of hazardous waste sites or toxic chemical releases.

In this paper we propose to build upon previous findings using the results of the 2010 Census of Population which are now available. In addition, our research employs a combination of regression and cluster-based techniques to explore changes in the populations of the 3,107 counties in the forty-eight contiguous states over the most recent decade. Initially, we considered a large number of economic and amenity-based items along with climate, topographic and rural-urban variables as a means to identify the factors which influenced population change at the county level over past decade. Later, we classified the counties into clusters designed to group together counties with similar characteristics within each cluster, while emphasizing the dissimilarities among counties appearing across clusters.

Description of the Variables

Our criterion or dependent variable identifies the overall percentage change in county population from 2000 to 2010 in each of 3107 counties in the 48 contiguous states. Initially, we selected a large number of predictor variables, and eventually reduced this number to ten based upon preliminary regression tests. Only the variables which were significant in the initial analysis were retained in the final regression model.[1] The list of variables included in the final regression as well as the variable descriptions and the expected signs on the coefficients appear in Table 1.

Table 1
Variable Definitions and Expected Signs on the Coefficients

Variable	Variable Description	Interpretation of the Sign on Coefficient	Expected Sign on Coefficient
Percent Change in Overall Population (Dependent)	Percentage change in overall county population from 2000 to 2010	Increase in population = + Decrease in population = -	n/a
Size of age 18-44 cohort	Number of individuals in the county between the ages of 18-44 in 2000	Increase in cohort size = + Decrease in cohort size = -	Not Predicted
Size of age 45-64 cohort	Number of individuals in the county between the ages of 45-64 in 2000	Increase in cohort size = + Decrease in cohort size = -	Not Predicted
Size of age 65 & older cohort	Number of individuals in the county who were 65 years or older in 2000	Increase in cohort size = + Decrease in cohort size = -	Not Predicted
Rural-Urban Index, Beale Codes, (RUCC)	Rural-urban continuum code 0-9 as of 2003; 0 = central counties, 9 = completely rural	Less urban = + More urban = -	Negative
Natural Amenity	Natural Amenity Index; Deviations from the mean, 1 = low amenities, 7 = high amenities	More amenities = + Fewer amenities = -	Positive
Percent Water	Percent water area within county	Higher % water = + Lower % water = -	Not Predicted
Mean January Temperature	Average January temperatures, 1941-1970	Higher temperatures = + Lower temperatures = -	Positive
Median Household Income	Median Household income, 2006-2010	Higher incomes = + Lower incomes = -	Positive
Percent Non-Farm Change in Employment	Percentage change in private, non-farm employment, 2000-2009	Increase in employment = + Decrease in employment = -	Positive
Percent change in number of Social Security Recipients 2000-2005	Indicator of change in the percentage of persons in the age 65 and over category	Higher % change = + Lower % change = -	Positive

The first three variables in the table capture the cohort sizes pertaining to the demographics of the adult population in each county. The variables reflect the number of persons in each county in the age ranges 18-44, 45-64, and 65 and older as reported in the 2000 and 2010 U.S. Censuses of Population.

The signs on these three coefficients were not predicted in advance; however, a positive sign indicates a direct relationship between the initial size of the cohort and the percentage change in the overall population. As noted earlier, each of the three cohorts increased in size nationally over the ten years; however, a careful study is required when we examine these changes at the county-level. As an example, a positive coefficient on the age 65-and-over category might suggest that the overall population of the county is increasing if this occurs in a high-retirement area. However, the sign on the number of persons age 65-and-over in a county will be negative if the county has experienced a high outmigration in the number of persons in the younger age categories moving to locations outside the county. As a result, the county may have lost population, and is left with a mostly older population, thus generating an inverse relationship between this variable and the rate of change in overall population in the county.

The sign of the coefficient on the Rural-Urban Continuum Code (Beale Code) was expected to be negative to indicate that rural, nonadjacent counties are anticipated to experience less growth than counties in the urban/metro regions.

A natural amenities index developed by the Economic Research Service Division of the United States Department of Agriculture produces an amenity code ranging from one (low amenities) to seven (high amenities) for all counties based on deviations from the mean. A positive sign on the amenity index is predicted indicating that the presence of more amenities in a region generates increases in population.

The percentage of surface area covered by water might be expected to produce a positive relationship with population growth if it is viewed as a desirable amenity; however, this is countered by a negative relationship when population growth occurs in largely urban areas which are devoid of lakes and streams. Thus, the sign on this coefficient was not predicted in advance.

The climate effect was captured by the mean January temperature from 1941-1970 in each county. A positive sign indicates a direct correlation between higher winter temperatures and population growth, and is consistent with the trend of the population movements to the South and West regions of the U.S.

The household income and non-farm employment growth variables are proxies for the economic conditions existing in the counties. Higher income levels and employment growth in a county are generally predicted to stimulate higher levels of population growth, thus we expect positive coefficients on these variables.

The sign on the percentage change in the number of Social Security recipients in the county in the initial half of the decade is a potential indicator of whether or not that county is undergoing population growth. A positive sign is expected since an increase in the percentage of Social Security recipients in an area could suggest a higher level of overall population in the county as the number of elderly persons increases; although a negative coefficient could indicate a large number of people aging-in-place even though the overall population in a county may be declining.

Regression Analysis

Stepwise regression was used to obtain the final set of predictor variables in the equation. Variables were included so long as they increased the contribution to the coefficient of multiple-determination.

The F statistic for the final equation was 466.04 which is significant at less than 0.0001; and the adjusted R Square was 0.60. The regression results appear in Table 2. Each of the regression coefficients used in the final equation is significantly different from zero at the 0.05 level or less. The standardized coefficients are also included in the table to indicate the relative importance of the variables with respect to their impacts on the criterion variable. The explanatory variables appear below in order of their importance using the standardized coefficients.

Table 2
Stepwise Regression Results
R Square = 0.601   Adjusted R Square = 0.600   n = 3107

Explanatory Variable	Coefficients	Standardized Coefficients	t Stat	P-value	VIF
Intercept	-16.855	---	-4.272	***	---
Percent Δ Social Security Recipients	.747	.518	34.811	***	1.720
Percent Non-Farm Δ Employment	.121	.215	17.554	***	1.161
Median Household Income	.000	.210	13.807	***	1.795
Mean January Temperature	.121	.110	7.929	***	1.502
Share of the Age 45-64 Cohort	-.472	-.097	-6.100	***	1.952
Share of the age 65 & Older Cohort	.311	.097	4.664	***	3.379
Share of the age 18-44 Cohort	.240	.091	4.233	***	3.618
RUCC (Beale Codes)	-.339	-.069	-4.368	***	1.939
Percent Water Area in County	-.070	-.060	-5.022	***	1.097
Natural Amenity Index	.676	.054	4.043	***	1.366

*** $p < .001$ (two-tailed tests)

Pallant (2010) and also Tabachnick and Fidell (2007) discuss an alternative approach to determine how much of the total variance in the dependent variable (population change) is uniquely explained by each explanatory variable. Under this approach, the 'part' or semi-partial correlation coefficients are each squared to generate the contribution of each variable to the R square. Since these values represent only the unique contribution of each variable, Pallant points out that the sum of the squares of these coefficients will not equal the R square since R square includes the unique variance attributed to each variable as well as the shared or overlapping variance due to the presence of all of the variables.

The unique contributions of each of the variables appear Table 3. Using this approach, the percentage change in Social Security recipients uniquely explains about 15.1 percent of the variance in county population change, followed by Non-Farm employment differentials which account for about four percent of the variance in the population change.

Table 3
Total Variance in Population Change Uniquely Associated with each Variable

Explanatory Variable	Percent of Total Variance in Population Change Uniquely explained by each Variable
Percent Δ Social Security Recipients	15.60%
Percent Non-Farm Δ Employment	3.96%
Median Household Income	2.46%
Mean January Temperature	0.81%
Share of the Age 45-64 Cohort	0.48%
Percent Water Area in County	0.32%
Share of the age 65 & Older Cohort	0.28%
RUCC (Beale Codes)	0.25%
Share of the age 18-44 Cohort	0.23%
Natural Amenity Index	0.21%

Discussion of the Regression Results

The percentage change in the number of Social Security recipients in each county was responsible for the largest amount of the predictive power generated by the variables in the equation. The positive sign on the coefficient suggests that counties with large percentage increases in Social Security recipients were highly likely to have experienced the greatest amount population growth from 2000 to 2010.

The percentage change in non-farm employment between 2000 and 2010 was the second most important variable, and it is also aligned with the economic-oriented variables in this study. The positive sign on this coefficient was expected and confirms that growth in employment and in population are still very much in step.

Median household income closely follows the non-farm employment variable in importance. The positive sign on the coefficient suggests that counties with high levels of household income were most likely to have experienced greater population growth from 2000 to 2010. This is evident from our data as many of the high-growth counties are found in the high-income counties in Maryland and Virginia near Washington, D.C. as well as in parts of New Jersey as well as in many counties surrounding San Francisco.

Winter temperatures as measured by the Mean January temperature over a 30-year period serve as a proxy for climate conditions. This variable had a positive sign which is consistent with our expectations and suggests that counties with higher winter temperatures are more likely to experience more population growth. This corresponds with the movement of persons to the warmer climates in the southern regions of the U.S. which have experienced more rapid population growth.

The share of the population cohort comprising the baby-boomers, those between 45 and 64 years of age, was the next variable in terms of importance in explaining population growth over this decade. However, the negative sign on the coefficient at first appears to be counterintuitive. Although the data show that the population between ages 45 and 64 is the fastest growing cohort in the country, the counties which are growing at the higher percentage rates are found where the 18-44, and 65-and -over populations are increasing their shares instead. The signs on those two coefficients were positive, which combined with the negative sign on the 45-64 year variable, suggests that the faster- growing counties are either retirement-oriented locations containing higher numbers of Social Security recipients, or places to which younger persons are drawn such as counties containing universities or military bases.

The sign on the RUCC or Beale Codes was negative. This was expected and indicates that counties located in the largest metropolitan areas are growing the most rapidly, followed by other metro counties and counties adjacent to metropolitan counties, while rural counties, particularly those not adjacent to metro counties, experienced the least amount of population growth.

The percent of the county surface area covered by water (lakes, rivers and streams) has a negative coefficient. We did not predict the sign of this variable because the relationship with population growth can be in either direction. The negative sign on this coefficient indicates that counties with less water were more likely to grow the most rapidly. This is consistent with the high-levels of growth inside many of the nation’s metropolitan counties which grew as a result of strong economic factors, but where we find smaller amounts water including fewer lakes and ponds. Alternatively, it could be argued that more water in a region constitutes a positive natural amenity and should stimulate more population growth instead of less. This would certainly be true in some counties; however, the overall population growth was highly skewed to the urban rather than rural regions, and suggests that while more water may be a positive factor behind population growth in a specific county, it is outweighed by the larger numbers of people residing in the urban areas as opposed to smaller numbers in the rural locations.

Finally, the Natural Amenity Index coefficient also has a positive sign suggesting the higher relative amounts of natural amenities present in a county, are associated with larger population growth.

Testing the Assumptions of the Model

Variance inflation factors (VIF) were used to test for multicollinearity in the model. The values for the VIF provide a measure of the severity of multicollinearity in ordinary least squares regression models. The VIF uses an index to measure how much the variance of an estimated regression coefficient increases as a result of collinearity among the variables. We assume the presence of significant amounts of multicollinearity exists when a value for the VIF for a coefficient exceeds five, while other researchers suggest that VIFs with values exceeding ten indicate that the coefficients for the explanatory variables are of minimal value.

No correlation is assumed to exist when the individual VIFs equal one. As shown in Table 2 earlier in this paper, the individual VIF values for each variable in our analysis all are less than four which indicates only minimal amounts of multicollinearity.

A test for heteroscedasticity in the model was conducted using scatter plots of the variance in each. An analysis of these plots indicated no evidence of heteroscedasticity is evident.

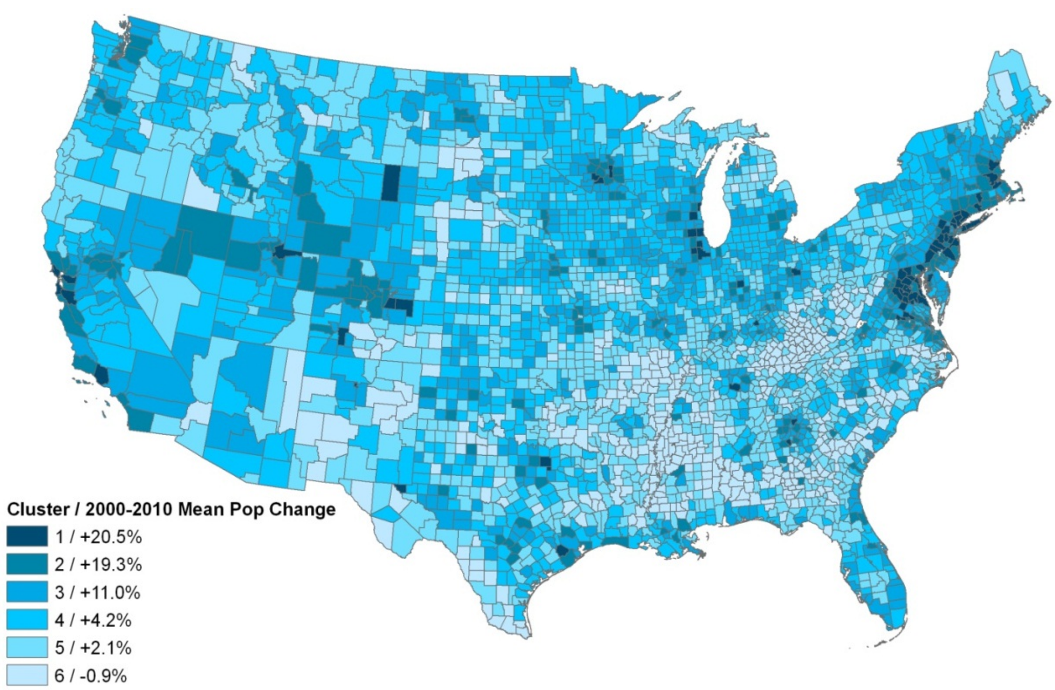
Cluster Analysis

Based upon the results of the regression analysis, we employed cluster analysis in order to obtain a better-defined picture of the changes in population over this period. K-Means cluster analysis was used to assign each of the 3,107 counties into groups or cluster of counties which share similar characteristics across the set of the explanatory variables in the regression model. Therefore, counties within the same cluster will exhibit similar profiles, while counties located in different clusters will contain contrasting profiles.

The selection of the number of clusters to employ is often based on researcher judgment. This decision can either be determined in advance of performing the analysis, or it can be made in the post-analysis period based upon interpretation of the results. In this study, we reviewed the results of the cluster technique for five, six, seven and eight clusters. Based upon our findings and understanding of the results, we proceeded with six clusters for this analysis.

Figure 1 contains a map of all U.S. counties in the 48 contiguous states broken out by their classification into clusters. The clusters are numbered based upon the mean values of the population changes between 2000 and 2010. The mean level of population change in the counties in Cluster 1 was 20.5 percent. Counties in Clusters 2 through 5 had positive but lower mean values in population change. Counties in Cluster 6 experienced a mean value of negative 0.9 percent change in population, and this is the only cluster where the mean level of population actually declined over the 2000-2010 period.

Figure 1
U.S. Map with Counties Contained in Each Cluster



Interpreting the Cluster Results

The cluster means showing the percentage change in population are presented in Table 4 along with the cluster means for each of the 11 explanatory variables in our model. A clear and consistent picture emerges from this cluster procedure. Maps which show the counties that comprise the six individual clusters appear in Appendix A. A description of each of the clusters follows.

Table 4
Mean Rates of Change of County Populations
and for the Ten Explanatory Variables for each Cluster

	Cluster 1 (n=80)	Cluster 2 (n=196)	Cluster 3 (n=503)	Cluster 4 (n=917)	Cluster 5 (n=928)	Cluster 6 (n=483)
%Change in Population	20.5	19.3	11.0	4.2	2.1	-0.9
% Δ Social Security Recipients	16.08	14.76	9.12	5.25	4.95	3.99
% Non-Farm Δ Employment	16.86	13.58	6.54	1.68	-4.11	-7.43
Median Household Income	84209.53	64819.18	52960.53	44728.15	38073.91	30228.10
Mean January Temperature	31.81	32.60	30.33	29.61	34.27	39.48
Share of Ages 45-64	23.87	23.29	23.20	23.13	23.70	23.36
Share of ages 65 & Older	9.95	10.75	13.22	15.46	16.07	15.27
Share of ages 18-44	39.65	39.53	37.59	36.03	35.33	35.59
RUCC (Beale Codes)	1.55	2.33	3.67	5.07	5.92	6.87
%Water Area in County	12.06	7.93	6.54	4.49	3.59	1.85
Natural Amenity Index	3.65	3.96	3.51	3.32	3.53	3.51

Cluster 1: High Growth, High Income, Urban Counties

Cluster 1 is the smallest cluster, containing only 80 counties. These counties are primarily located in regions near and surrounding Washington D.C. along with many of the suburban San Francisco counties, others in the Chicago area, and a few additional counties scattered about the country.

Counties in the first cluster experienced the highest mean level of population growth over the past decade. The primary characteristics defining this cluster are:

- The most urban cluster according to the Beale Codes
- The highest percentage increase in Social Security recipients
- The highest level of incomes
- The highest percentage change in non-farm employment
- The highest percentage of water area contained within its counties
- The highest shares in the age groups for both the 18-44 and 45-64 populations

Based upon a review of these characteristics, it becomes evident that the fastest growing counties in the U.S. over the first decade of this century are primarily found in the most urban regions, and are also the most-wealthy counties in the nation. These counties also demonstrated the most desirable performances on most of the economic-related dimensions. In addition, the percentage of water area in these counties greatly exceeds the percentages for all other clusters, thus suggesting that many of these areas contain lakes and streams, or may be located in the coastal regions of the country. Given this combination of favorable features in these counties it should not be surprising that these locations experienced the highest levels of overall population change.

Cluster 2: High Growth, High Natural Amenities

Cluster 2 is similar to Cluster 1 on many dimensions. This cluster experienced almost as much population growth as the counties in Cluster 1 (19.3% vs. 20.5%.) However, this cluster contains over twice as many counties (196 vs. 80 counties) and has the highest score on the Natural Amenities Index. Cluster 2 membership is primarily drawn from counties located in the Seattle, Portland, Southern California and Minneapolis-St. Paul urban areas as well as amenity-rich counties in Colorado, Utah, Wyoming, Virginia and areas along the New England coast.

Counties in Cluster 2 are identified by the following characteristics:

- The highest score on the Natural Amenity Index
- The second most urban cluster according to the Beale Codes
- The second highest percentage change in Social Security recipients
- The second highest percentage of water area contained within its counties
- The second highest level of incomes
- The second highest percentage change in non-farm employment

Therefore, this cluster is similar to Cluster 1 in that it experienced high population growth and shares many of the same characteristics; however, counties in Cluster 2 contain more natural amenities, and although median incomes are well above the U.S. average, these counties are not nearly as wealthy as those in Cluster 1. Based upon these variables, it should not be surprising that Cluster 2 counties also experienced high levels of population growth over the decade.

Cluster 3: Medium Growth, Attractive Places to Live

Cluster 3 represents a middle-of-the-road cluster since it scored near the middle on most of the dimensions. This cluster contains 503 counties, making it substantially larger than the first two clusters; however, it is only about one-half the size of some of the low-growth clusters in the model. This cluster draws its members from 46 of the 48 states included in the study, and no single state or region appears to dominate in terms of geographic measures. Population change in these counties increased by a respectable 11 percent over the decade, and is clearly in the middle range among the clusters, lagging far behind the growth in the first two clusters, while at the same time growing by three to six times the rate of change experienced in the lagging clusters.

Cluster 3 is identified by the following characteristics:

- Low Mean January Temperatures
- The third most urban cluster according to the Beale Codes
- Ranked 3 out of 6 on the percentage increase in Social Security recipients
- Ranked 3 out of 6 on the percentage of water area contained within its counties
- Ranked 3 out of 6 on the highest level of incomes
- Ranked 3 out of 6 on the percentage change in non-farm employment

Counties in this cluster increased in population at a healthy rate and are drawn from many attractive regions including the coastal regions in Florida and the Great Lakes along with many large and medium-sized population centers in the West in and around Phoenix, Denver, Salt Lake City, Las Vegas, Reno, Albuquerque and Boise.

Cluster 4: Low Growth, Low Temperature, Low Retirement Areas

Cluster 4 is the first of the low-growth groupings of counties when compared to the numbers in the first three clusters. Population change in these counties averaged 4.2 percent over the decade which is only a fraction of the average growth in the clusters discussed above. This cluster contains 917 of the 3,107 counties, or almost 30 percent of the total counties. The cluster draws its membership from counties in 45 states, with a large number located near the Great Lakes, and others from the Midwest and Great Plains states. Many of these counties are located in the low-temperature, colder regions of the nation. Furthermore, these counties are substantially more rural when compared to the earlier clusters, and are often found in areas not adjacent to metropolitan counties. This is evident from the mean score on the Beale Codes of 5.07 in contrast with the much lower Beale scores in the earlier clusters.

Counties in Cluster 4 typically contain the following characteristics:

- Lowest Mean January Temperatures of all the clusters
- Not adjacent to metropolitan regions according to the Beale Codes
- Lower levels of income, ranking 4th out of the 6 clusters on median incomes
- Small change in non-farm employment, averaging only 1.68 percentage growth over the entire decade
- Lowest level of natural amenities among all the clusters
- Lowest share of the population of ages 18-44 among all the clusters

These counties also are often agriculture or manufacturing-based, which have experienced some but slow growth in recent years. However, the small number of residents in the 18-44 age group is likely related to an outmigration of much of its youth population once they reach age 18.

Cluster 5: Low Growth, Declining Employment, Rural Areas

Population growth rates in this cluster averaged slightly over two percent for the decade, or only about one-half the increase in Cluster 4. This cluster contains the largest number of counties of all the clusters – 928 counties – or just slightly above the number in Cluster 4. Incomes in these counties were substantially less than those in Cluster 4, and non-farm employment declined by more than four percent over the course of the decade.

The defining characteristics in Cluster 5 include:

- The second most rural of all the clusters
- The largest increase in the population ages 65 and older
- The second lowest level of median income found in the clusters
- A decline of over 4 percent in non-farm employment over the decade

Therefore, it is likely many counties in this cluster are struggling with trying to retain their population base in an environment of declining employment opportunities. The problem is widespread with counties in this cluster drawn from 41 states. Only portions of the Mid-Atlantic region and much of New England are not represented in this cluster.

Cluster 6: Negative Growth, Declining Employment, Rural Areas

Counties in Cluster 6 were the only ones as a group to experience an average decrease in population levels over the decade from 2000-2010. The rate of change in population in these counties declined by an average of 0.9 percent during this period, while the change in non-farm employment in these counties decreased by 7.43 percent. This represents the weakest performances of all the clusters as measured by most of the variables in our study.

The defining characteristics in Cluster 6 include:

- The only cluster to lose population
- One of two clusters to experience declines in employment, averaging over a seven percent loss
- The most rural of all the clusters
- The highest average January temperatures of all the clusters

- Minimal amount of water-based areas
- The lowest level of median income in the clusters by a large margin, with incomes averaging only 35 percent of the income levels in the highest-ranking cluster

Cluster 6 contains 483 counties, but these are not as widespread as in many of the other clusters. These counties are drawn from only 22 states, primarily from the Southeast and Deep South regions along with scattered counties in New Mexico, west and south Texas, as well as portions of western South Dakota and Nebraska. January temperatures were substantially higher than in any other cluster, in large part reflecting the southern counties where the vast majority of this cluster's counties are found.

Discussion

In summary, we identified six clusters. Three of these represent healthy high-growth regions with above average incomes and employment. Furthermore, most counties in these clusters are primarily urban in nature and generally have more favorable amounts of amenities than counties in the remaining clusters. On the other hand, the other three clusters contain many conditions which are the exact opposite on most dimensions. The low levels of population growth (and an actual decline in population in Cluster 6) strongly contrast with the experiences of the first three clusters, and are largely found in situations which exhibit weak economic conditions, fewer amenities, and increased isolation due to the more rural nature of the counties located in these clusters.

The results tell a story of a nation that may be moving in two different directions as population is increasing more rapidly in high-income, high-employment, urban regions, leaving the low income, low-amenity, more rural and economically depressed areas further behind, not just for the short term, but potentially for the long-term as well. This also could contribute to the explanation of the growing divergence in political and social viewpoints in the U.S. which have increased in the early 21st century. This conclusion is troubling if the nation is moving toward a geographical split of the "have's and have not's" among counties based upon increasing levels of income inequality that exist across the clusters. Based upon the relative contribution of the variables in the regression, divergence in economic conditions as opposed to differences in non-economic variables accounted for the primary influence on population change during this period although both are important.

Therefore, the large diversity in population growth rates and the side effects associated with these changes can be attributed to both economic and noneconomic factors, but they may confirm the emergence of a two-tiered level of economic welfare in the nation accompanied by increasing divergence in the quality of life found in the different clusters across the nation. This in turn may spawn increased levels of social unrest in future decades and is worthy of further research to examine whether or not these numbers support the thesis that the nation is becoming increasingly polarized not only economically, but also geographically.

Endnotes

(1) A partial list of the variables which were not significant includes the percent of persons below poverty level, percentage completing a bachelor's degree, amount of federal expenditures, number of hospital beds, per capita expenditures for food and accommodation, median home values and the percentage change in county population during the decade preceding the time period used in the current paper.

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Appendix
Maps of Counties Contained in each Cluster

Figure A-1
Counties in Cluster 1

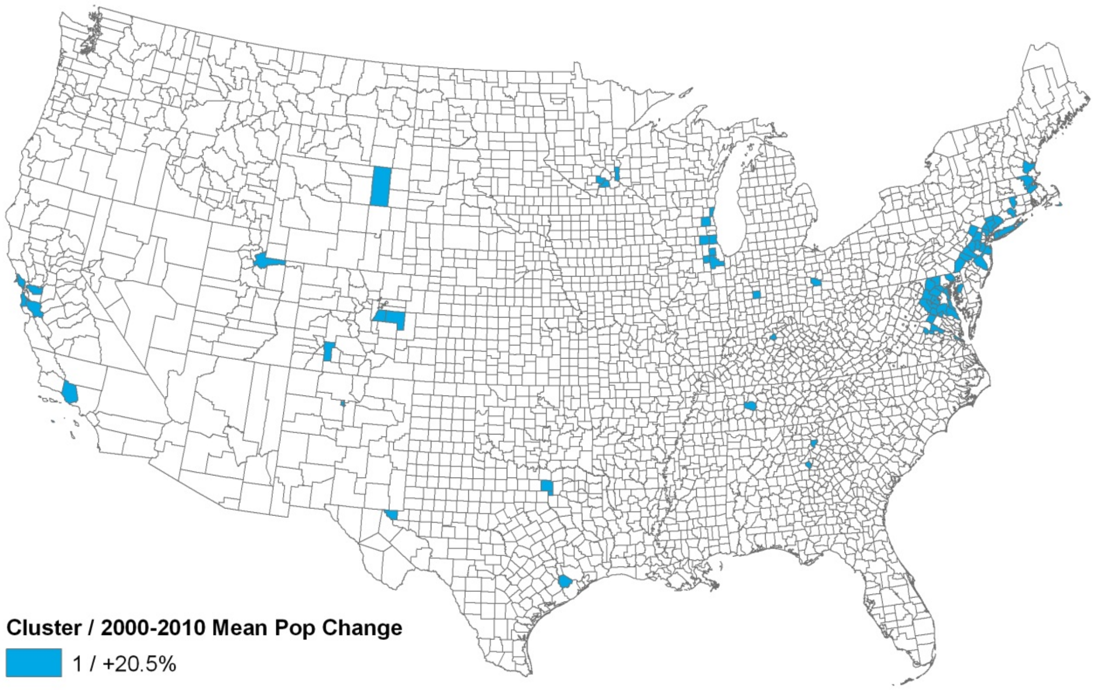

Figure A-2
Counties in Cluster 2

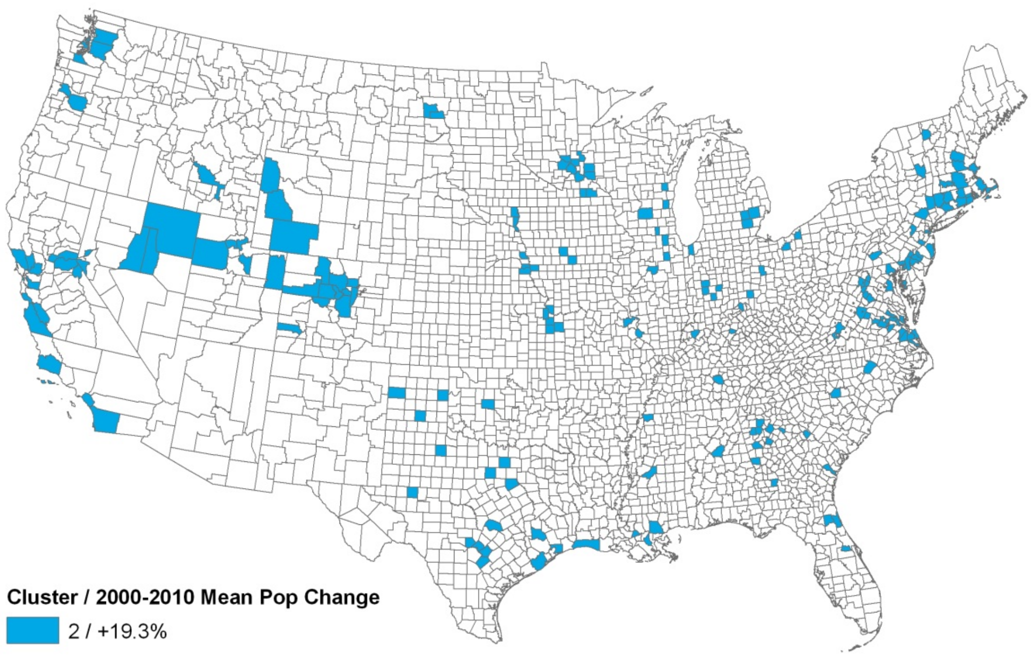

Figure A-3
Counties in Cluster 3

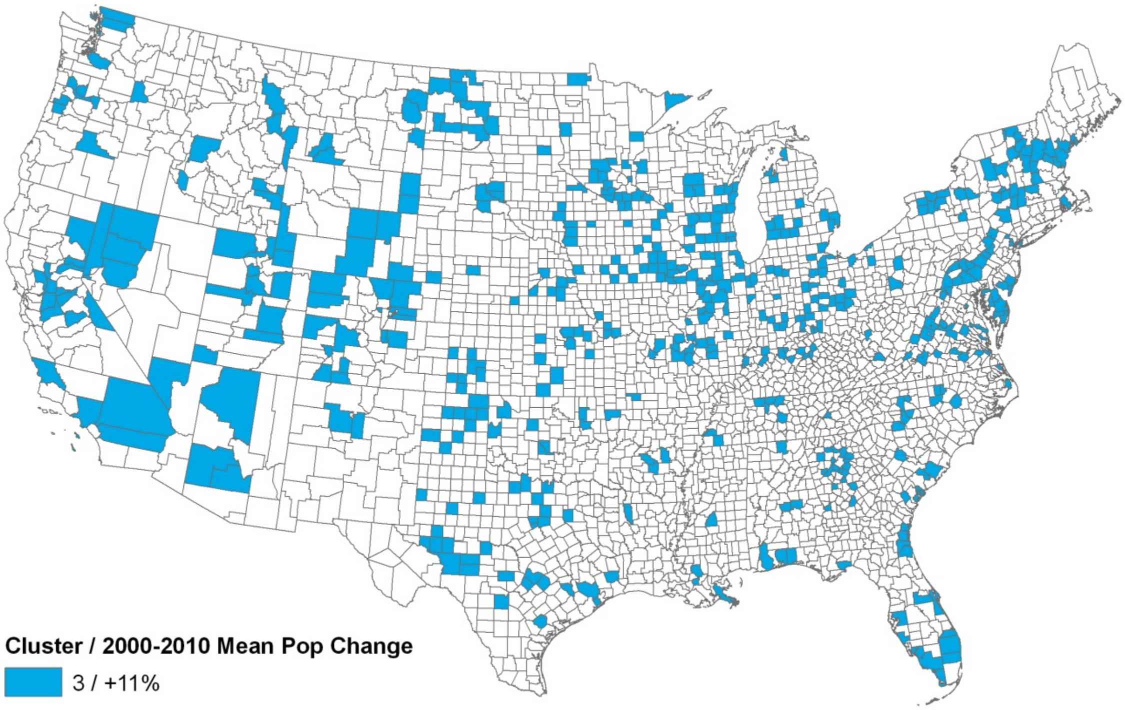

Figure A-4
Counties in Cluster 4

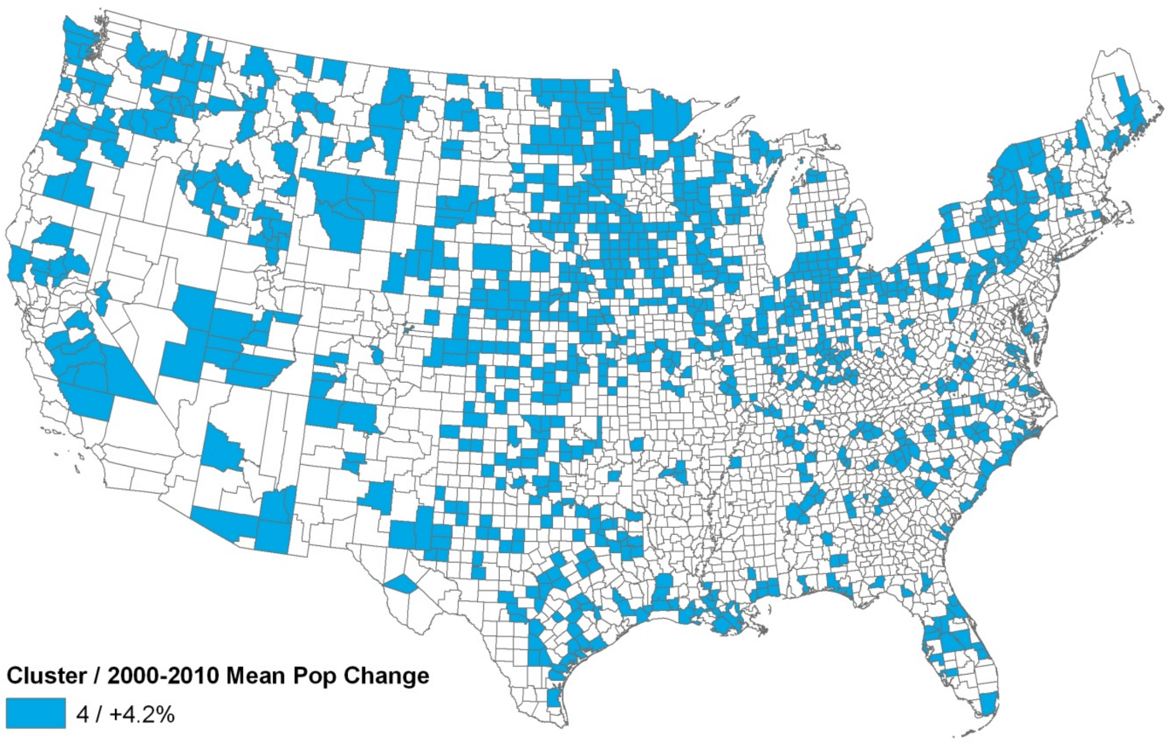

Figure A-5
Counties in Cluster 5

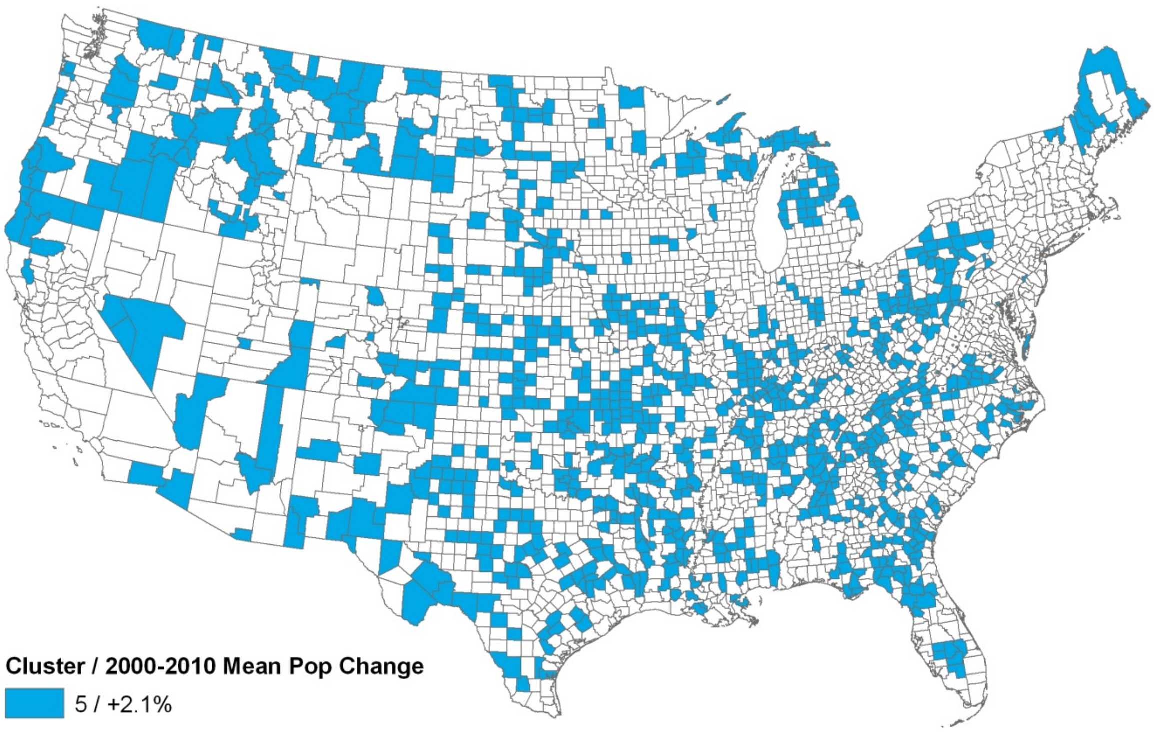

Figure A-6
Counties in Cluster 6