The Role of Amenities and Quality of Life In Rural Economic Growth

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A structural model of regional economic growth is estimated using data for 2243 rural U.S. counties. Five indices designed to capture specific amenity and quality of life characteristics are constructed using fifty-four separate indicators Results suggest that amenity characteristics can be organized into consistent and meaningful empirical measures that move beyond ad hoc descriptions of amenities. In addition to insights into the influence of local characteristics ranging from tax burdens to income distribution on regional economic growth, results suggest that predictable relationships between amenities, quality of life, and local economic performance exist.

Key words: economic growth, amenities, quality of life, rural.

Rural economic structure in many parts of the United States has undergone significant changes over the past two decades. Traditional goods-producing sectors such as agriculture and manufacturing are giving way to service-producing sectors, such as those that support natural resource-based leisure activities. As America becomes more urban the resources that· rural areas offer, like open space, natural amenities, and "small town values," become more valuable. Increasingly, people appear to be placing greater value on natural resource-based amenities and related attributes that contribute to regional quality- of life. One behavioral manifestation has been a willingness to relocate to experience these attributes. Indeed, many researchers, such as Howe, McMahon, and Propst, conclude that Americans are moving to rural areas in search of amenity attributes to improve their quality of life.

Numerous studies have documented that quality of life plays an increasingly important role in community economic growth (Dissart

and Deller; Halstead and Deller, Rudzitis). In a detailed review of the literature, Gottlieb suggests that the argument for using amenity attributes as an economic growth tool appears powerful. Even if such a strategy fails to create additional job and income growth, constituents presumably would benefit. Concern has been expressed., however, that such changes may yield higher levels of local underemployment, lower income levels, and generally lower overall economic well-being (Marcouiller and Deller). There is a perception that substituting traditional jobs in resource extractive industries and manufacturing with more service oriented jobs yields inferior earnings power, benefits, and advancement potential.

While shifts from market-based (e.g., extractive and manufacturing) activities to non-market-based (e.g., recreation and retirement) activities are well documented in the rural economic growth literature (e.g., Mills, Walzer and Deller), the impact of this shift on the structure of regional economies and the well-being of rural residents is not well understood. A fundamental reason for the limitation of the current literature, and subsequent policy discussions, hinges on the fact that amenity attributes are latent non-market inputs into the production processes of local economies (Marcouiller). For example, forest resources once viewed as a source of raw materials for wood products are now valued for their recreational uses or as aesthetic

backdrops for homeowners. Unfortunately, the current methods of modeling regional economic structural change and growth fail to capture these non-market attributes of the rural natural resource base (Marcouiller and Deller).

The intent of this research is to expand our understanding of the nature and extent of economic structural changes in the rural United States with a particular focus on the role of non-market amenity attributes. Two overriding goals include: (1) the construction of a family of consistent measures of amenities and quality of life and (2) the determination of the role of amenity and quality of life attributes in regional economic growth. We utilize a modified version of the widely used Carlino and Mills model of regional economic growth to test our hypotheses. Data for the. analysis are for 2243 non-metropolitan U.S. counties and come from a range of sources including BEA-REIS, City and County Data Book, and the NORSIS data set maintained by the USDA Forest Service.

The article is composed of six sections beyond the introduction. In the next section we provide an overview of the current thinking about the role of amenity attributes in rural economic growth. We then propose a structural model of growth. Following the next section, we outline our approach to defining and constructing amenity attribute measures. The empirical specification of the model is then laid out and our empirical results are discussed. The article closes with a summary and review of policy implications.

Rural Growth

Widespread population growth is underway in many rural areas and small towns across America, mostly as a result of changes in migration flows (Nord and Cromartie; Fulton, Fuguitt, and Gibson; Kusmin). A steady gain in rural population, through net migration, has occurred during the late 1980s and through the 1990s. During the first half of the 1990s, rural areas grew by 1.55 million persons. through in-migration, which is more than sufficient to offset the 1.37 million rural persons who migrated to metropolitan areas in the 1980s. The most recent data, however, suggest population growth rates for rural and urban areas have equalized.

Although the rural renaissance is widespread, it is uneven. The most recent analysis of population growth by the United States Department of Agriculture's Economic Research Service shows that rural areas with above average population growth are very common in the Mountain West. Much of this area is thinly populated, and thus small increases in population levels can translate into large growth rates. The new growth is large enough to be noticed and may affect the character of many places. Other areas of rural America experiencing above average population growth rates include the northern areas of the Upper Great Lakes, the Ozarks, the southern Blue Ridge Mountains, northern Florida, and several rural areas that adjoin thriving metro areas, such as Atlanta, Seattle, and Portland, Maine. Rural areas that are experiencing continued population decline include agricultural-dependent areas such as large parts of the Great Plains and the Corn Belt. For these areas, the declining importance of manufacturing and farming can be 'advanced as a primary cause of continued population decline. Similarly, rural areas that have had. high levels of growth in employment include the mountain West, upper Great Lakes states, and portions of the Pacific Northwest. Rural portions of the northern Rockies and Plains states have had higher than average increases in per. capita income.

For the rural parts of America that are growing most rapidly the cause does not appear to come from traditional resource extractive industries, and manufacturing. Rather, analyses by Nord and Cromartie and Beale and Johnson, among others, suggest that natural amenities and other non-market attributes that contribute to overall quality of life may be the driving factors, Beale and Johnson, for example, found that those rural areas classified as "recreational" account for 12 % of the nonmetro counties and 15 % of the nonmetro population. They further found that population growth in these counties has consistently exceeded those in other nonmetro areas as well as those in metro areas. Net migration accounted for most of the population growth in the twenty-four years . considered.

Using a different approach to defining recreational dependency, English, Marcouiller, and Cordell found that recreational .counties grew faster between 1980 and 1990 in terms of employment, income,

housing levels and value, and population than other nonmetro counties. In an analysis of spread and backwash effects of urban growth on surrounding rural areas, Henry, Barkley, and Bao found that those rural areas with higher levels of certain amenity attributes were more likely to capture positive spread effects. Rural areas with lower levels of amenities, on the other hand, tended to lose economic activities to the nearby growing urban center. In contrast, in a more focused study of federal wilderness areas in the western United States, Duffy-Deno found that expanding wilderness areas had no effect on county level resource-based employment.

The notion that amenities and quality of life in general are playing an increasingly important role in migration decisions is well established (Greenwood). Graves (1979, 1980, 1983) was the first to make popular the argument that rising income and wealth leads to an increased demand for location-specific amenities. Graves argued that the historically poor performance of migration prediction studies was directly attributable to their failure to account for amenity factors. Following the lead of Graves, Porell attempted to ascertain the relative importance of economic versus, amenity factors, as well as trade-offs between the two in explaining aggregate migration between twenty-five metro areas over the 1965–70 period. He concluded that the "regression results.. . provide strong empirical support to the premise that both economic and quality of life factors are important determinants of mjgratjon" (p. 152).

More recent theoretical work by Roback (1982, 1988) and Blanchflower and Oswald suggests that amenities and quality of life factors are capitalized into wages and rents in a manner that could hinder economic growth policies. Given mobile homogenous workers who locate in areas to maximize utility and equally mobile profit maximizing firms, in a spatial equilibrium regions will offer wage'rates and land rental prices that exactly offset benefits that accrue from their natural resource amenity differences. Workers who resjde in low amenity regions must be compensated via higher wages compared to workers locating in high amenity areas. Blanchflower and Oswald. extend this result and suggest that in a world of unemployment insurance and minimal public support programs, persons in high amenity areas would even be willing to accept periods of unemployment compared to workers who live in low amenity regions. If these views of amenities and quality of life are correct, and empirical evidence is building suggesting that they may be (e.g., Deller and Hsiu), then regions with high levels of amenities should experience lower wages and higher unemployment.

Conventional wisdom seems to imply that as the nation becomes wealthier; its demand for amenities and quality of life will increase. The simpler descriptive literature and the more analytic migration literature seem to support this notion. Still, the rigorous theoretical result of Roback and subsequent empirical work suggest that we do not fully understand the relationship between amenities, quality Of life, and rural economic growth.

One difficulty with the available literature that attempts to link amenity attributes to *regional* economic performance is the ad hoc theoretical and empirical approaches adopted. In earlier m&ration. literature, amenities were simply a function of climate. In the classic study of county-level population and employment growth by Carlino and Mills, crime was the only raw amenity measure. Recognizing the scarcity of amenity data at this scale, Carlino and Mills used central-city, suburban, and nonmetropolitan dummy variables to proxy congestion-related amenities and regional dummies to proxy climate.

A common practice within the literature is to confine amenities to a single dimensional attribute, such as climate or crime rates, or to introduce an ad hoc list of selected attributes (Andrew, Gottlieb). For example, in recent work by the USDA, ERS defined natural amenities as a summary index of mild sunny winters, moderate summers, with low humidity, varied topography, mountains, and the abundance of water (Nord and Cromartje). In his review of the literature, Gottlieb concluded that the literature attempting to link amenjtjes with economic growth has tended to be ad hoc and not sufficiently matured, theoretically or empirically.

These shortcomings have profound effects on public policy that addresses rural growth and natural resource management. If policy is to build upon the structural shift occurring in rural America, it is fundamental that we more fully understand, both theoretically and empirically, how amenities and quality of life attributes affect regional economic performance. By advancing the literature

beyond single dimensional thinking about what defines the stock of natural resource-based amenities and other quality of life attributes, we can gain further insight into policy options for rural areas. By more closely and rigorously identifying which attributes most influence regional economic performance, we can gain better insight into policies to preserve and advance those attributes. If some amenities are non-market latent inputs into the regional economy, identification of those amenities is vital to the development of sound, sustainable growth policy.

A Structural Model of Growth

Models of regional economic growth often focus on the interdependencies of household residential and firm location choices. Often this view addresses the notion of whether "people follow jobs" or "'jobs follow people" (Steinnes and Fischer). To address this issue of causation and interdependency, Carlino and Mills constructed a now classic two-equation system. This model has subsequently been used by a number of regional scientists to examine regional economic growth (Boarnet; Duffy; Duffy-Deno; Henry, Barkley, and Bao; Barkley, Henry, and Bao; Henry et al.). In this article; we expand upon the original formulation of the Carlino and Mills model to capture explicitly the role of income. We expand the "people versus jobs" debate from two-dimensional to three-dimensional: "people versus jobs versus income." In the traditional migration literature, people migrate to capture higher wages or income. By expanding the classic Carlino and Mills model to explicitly trace the role of income in regional growth, we more fully capture the growth process. The expanded model also explicitly captures the increasing concern about job quality as measured by income levels those jobs can support.

In general, we assume that both households and firms are free to migrate. Utility-maximizing households migrate in search of utility derived both from the consumption of market goods and non-market amenities. Profit-maximizing firms become mobile when looking for regions that have lower production costs and higher market demands. Based on this free migration assumption,

we are interested in the effects of amenity-based attributes on regional economic growth.

Precisely, we construct three central hypotheses in this research:

H1. Growth is conditional upon historical growth patterns.
H2. Growth is conditional upon initial condiiions.
H3. Growth is conditional upon regional amenity factors.

The first two hypotheses are drawn directly from the Carlino and Mills framework and are consistent with other studies, that have adopted this general theoretical approach. The latter hypothesis forms the heart of the current research agenda. Specifically, factors defining amenities are playing an increasingly important role in regional economic performance. Our goal is to examine formally and rigorously the level 'and degree of this hypothesized relationship as it relates to amenities.

Building upon Carlino and Mills the general form of the model is

$$(1) \quad P' = f(E^*, I' \mid \Omega^P)$$

$$(2) \quad E^* = g(P^*, I' \mid \Omega^E)$$

$$(3) \quad I' = g(P^*, E^* \mid \Omega^I)$$

where *P, E,* and I' are equilibrium levels of population, employment, and per capita income, and Ω^P, Ω^E, and Ω^I are a set of variables describing initial conditions and other historical information. Contained in the latter set of information are measures of amenity attributes. This formulation expands the model of Carlino and Mills by explicitly introducing income into the structural framework. This latter addition to the general Carlino and Mills framework is intended to explicitly draw attention to the question about job quality and wage levels.

Relying on the equilibrium conditions laid out above, a simple linear representation of those conditions can be expressed as

$$(4) \quad P^* = \alpha_{0p} + \beta_{1p}E^* + \beta_{2p}I^* + \Sigma\delta_{Ip}\Omega^P$$

$$(5) \quad E^* = \alpha_{0E} + \beta_{1E}P^* + \beta_{2E}I^* + \Sigma\delta_{IE}\Omega^E$$

$$(6) \quad I^* = \alpha_{0I} + \beta_{1I}P^* + \beta_{2I}E^* + \Sigma\delta_{II}\Omega^I.$$

Moreover, population, employment, and income.likely adjust to their equilibrium levels with substantial lags (i.e., initial conditions). Partial adjustment equations to the

equilibrium levels are

$$(7) \quad P, = P_{t-1} + \lambda_P(P^* - P_{t-1})$$

$$(8) \quad E_t = E_{t-1} + \lambda_E(E^* - E_{t-1})$$

$$(9) \quad I, = I_{t-1} + \lambda_I(I^* - I_{t-1}).$$

After slight rearrangement of terms this yields

$$(10)' \quad AP = P_t - P_{t-1} = \lambda_P(P^* - P_{t-1})$$

$$(11) \quad AE = E, - E_{t-1} = \lambda_E(E^* - E_{t-1})$$

$$(12) \quad AZ = I, - I_{t-1} = \lambda_I(I^* - I_{t-1})$$

where A,, λ_E and λ_I are speed of adjustment coefficients to the desired levels of population, employment, and income, respectively, which are generally positive; AP, *AE,* and AI are the region's changes in population, employment, and per capita income respectively; P_{t-1}, E_{t-1}, and I_{t-1} are initial conditions of population, employment, and per capita income. Substituting and rearranging terms allows us to express the linear representation of the model that is to be estimated as

$$(13) \quad AP = \alpha_{0p} + \beta_{1p}P_{t-1} + \beta_{2p}E_{t-1} + \beta_{3p}I_{t-1}$$
$$+ \gamma_{1p}\Delta E + \gamma_{2p}\Delta I + \Sigma\delta_{Ip}\Omega^P$$

$$(14) \quad \Delta E = \alpha_{0E} + \beta_{1E}P_{t-1} + \beta_{2E}E_{t-1} + \beta_{3E}I_{t-1}$$
$$+ \gamma_{1p}\Delta P + \gamma_{2pE}\Delta I + \Sigma\delta_{IE}\Omega^E$$

$$(15) \quad \Delta E = \alpha_{0I} + \beta_{1I}P_{t-1} + \beta_{2I}E_{t-1} + \beta_{3I}I_{t-1}$$
$$+ \gamma_{1I}\Delta E + \gamma_{2I}\Delta P + \Sigma\delta_{II}\Omega^I$$

Note that the speed of adjustment coefficient **(A)** becomes embedded in the linear coefficient parameters, a, **β, γ,** and 6. This framework is particularly useful for this analysis because it allows us to capture structural relationships while simultaneously isolating the influence of amenity attributes on regional **economic** growth. In essence, we are modeling short-term adjustments (i.e., **Δ P,** AE, and **ΔI**) to long-term equilibrium (i.e., *P, E,* and I').

Measures of Amenity and Quality of Life Attributes

Within the literature the empirical representation of amenity attributes has tended to be single dimensional, simplistic, and to a large extent ad hoc (Gottlieb). **The** method proposed here builds on the work of English, Marcouiller, and Cordell, and Wagner and Deller, among others The approach we adopt was advanced by Miller, who suggested that blocks of variables describing a particular attribute can be condensed into a single scalar measure that captures the information contained in the original data. For example, Dorf and Emerson reduced more than 100 different variables to sixteen **components** that together serve as fairly reasonable predictors of each of the original variables. They then used these components to predict firm location. More recently, **Barkley,** Henry, and Bao compressed several blocks of variables into single regressor components to isolate the influence of local school quality on rural economic growth. Wagner and **Deller use principal** component analysis to compress twenty-nine separate variables into five broad indicators of regional economic structure that are then used **as** controls in a study of the influence of economic diversity on regional economic performance.

Principal components is a method of compressing a set of related variables into a single scalar measure. **These** measures are, in essence, linear combinations of the original variables where the, linear weights are the eigenvectors of the correlation matrix between the set of factor variables Each factor is constructed orthogonal to the others. In other words, principal components is a mechanical method of inspecting the sample data for directions of variability and using this information to reduce a collection of variables into a single measure. Ideally, the final measure captures the essence of the original collection of variables While the pros and cons of principal components analysis, are well known, and a range of alternative approaches are available, we suggest that the approach used here moves the literature forward.

For this analysis we propose five broad-based indices of amenity and quality of life attributes: climate, land, water, winter recreation, and developed recreational infrastructure. We capture a region's climatic conditions such as temperature, precipitation, sunny winters, and dry summers. Developed recreational infrastructure represents a **region's** facilities, such as golf **courses,** tennis courts, swimming pools, playgrounds, and significant historical and cultural dimensions. . **In** the set of land variables, we want. to

capture a region's land resources, such as the percentage of acres included in federal wilderness areas, forestland, farmland, and state park land. The set of water variables accounts for the region's wealth of water resources, including the percentage of the county's land area comprised of river, lakes, and bays, and associated resources for recreational activities such as canoeing, diving, and fishing. Finally, in the *set* of winter variables, we try to capture the region's winter ski facilities and activities. We limit the current analysis to six variables to represent a region's climactic conditions, thirteen variables to portray developed recreational infrastructure, sixteen to represent land resources, twelve to depict water resources, and six to represent winter facilities.'

To do this we use the National Outdoor Recreation Supply Information System (NORSIS) data set developed and maintained by the USDA Forest Service's Wilderness Assessment Unit, Southern Research Station, Athens, Georgia. As an outflow of the 1998 Resource Planning Act Assessment of Outdoor Recreation and Wilderness, the FS maintains an extensive county-level data set documenting facilities and resources that support outdoor recreation activities. Many of these same resources are precisely the amenities that contribute to the overall quality of life of the region. The NORSIS data set contains over 300 separate variables ranging from population density, the proportion of county acres by type of land use, employment and income levels in recreational industries, to the number of public libraries for the year.1997.

Empirical Specification

In the design of the Ω^P, Ω^E, and Ω^I vectors, we follow the logic proposed by Wagner and Deller; English, Marcouiller, and Cordell; Duffy; and Deller and Hsiu. We hypothesize that there are four broad classifications of factors influencing regional economic growth:

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[1] The selection of a specific principal component relies on three rules of thumb. One rule suggests that one should choose the first principal component. This is because the first principal component is the best summary of the entire data set for it accounts for the most total variance in the correlation matrix across all of the variables. The second rule of thumb selects the principal components that have eigenvalues of the correlation matrix greater one. The third approach is to use every principal component that is generated. In the research we will have elected to use the first selection criteria.

markets, labor, government, and amenity attributes. The data are drawn from a range of sources, primarily the Bureau of Economic Analysis' Regional Economic Information System (BEA-REIS) and the City and County Data Book. The dependent variables for the three equations outlined in equations (13)–(15) are growth rates in population, employment, and per capita income from 1985 to 1995. When possible, we match right hand side variables to the beginning of the period. Descriptive statistics for these samples are provided in an appendix.

Market

In this category, we are attempting to capture factors that influence the demand side of regional markets. Generally, these factors are designed to describe the region's market size and consumption ability. We use five variables to capture market characteristics.

1. Percent of population that is nonwhite (1990).[2]
2. Percent of population that is above sixty-five years old (1990).
3. Percent of population that is under seventeen years old (1990).
4. Percent of households with income below the poverty level (1989).
5. Entropy index of income distribution (1989).

The entropy index is commonly used to capture regional income distributions. This index is given by $\Sigma_i x_i^2$, where each $x_i (i = 6)$ represents a percentage of households with a certain level of income? Other things being equal, a region with less-equal income distribution is associated with a higher entropy index.

Labor

This category is intended to capture the ability of regional markets to supply the goods and services needed to satisfy regional demand. Variables that measure human capital stocks and flows are sufficient to capture the influences of this side of the market on regional growth. Human capital here refers

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[2] The nonwhite population includes Black, American, Indian, Eskimo, Aleut, Asian, Pacific Islander. and Hispanic people.
[3] Overall, there are sir different levels of household incomes: (l) less than $15,000, (2) $15,000 to 524,999, (3) $25,000 to f34.999, (4) $35,000 to S49.999. (5) $50,000 to 574.999. and (6) $75,000 or more.

to broad levels of education, health, and attitudes. The variables we use to capture labor characteristics are:

1. Percent of persons with a high school diploma (3990).
2. Numbers of active nonfederal physicians per 100,000 population (1990).
3. Unemployment rate (1991).
4. Numbers of serious crimes per 100,000 population (1991).

Government

The local government's finance is fundamental to the growth potential of the region. On the one hand, high personal tax and business taxes are generally deemed to be detrimental to local economic growth. Yet, on the other hand, government revenue finances the local infrastructure and public services that may attract households and firms to establish in the region and then, eventually, stimulate the local economy. We use two variables to represent the local government's finance:

1. Property tax rate (1986-87).
2. Total government general expenditure (1986437).

Amenities

The role of amenity attributes is hypothesized to be a central factor in the economic growth of rural areas through its impacts on the quality of life within the region. As described above, these five sets of amenity variables are (1) climate, (2) developed recreational infrastructure, (3) land, (4) water, and (5) winter.

Estimation

While the system of equations outlined in equations (13)–(15) is simultaneous by design, we limit the analysis reported here to simple reduced form structure. If the system of equations outlined in equations (13)–(15) is complete, that is, the three by three matrix of endogenous variable coefficients is nonsingular, all of the information contained in the structural equations can be captured by expressing the endogenous variables as a function of all the exogenous variables plus a disturbance term. Since we are interested in isolating the role of the amenity and quality of life measures, and not necessarily the interplay of the endogenous variables, we estimate and report only the reduced form.

Empirical Results

For this analysis there are two distinct sets of empirical results: first, the principal component analysis used to construct the measures of amenity attributes and, second, the reduced form results of our model of regional economic growth. Each will be addressed in turn.

Amenity Measurement

The results of the principal components analysis for the five broad measures of amenity attributes are report in Tables 1-5. For climate (table 1) the final measure accounts for 46.2 % of the variation of the six separate input variables. Of the six variables, only January sunny, days and July temperature do not play an. important role in the final measure. Counties that have higher average winter and year-round temperatures and precipitation levels, as well as higher levels of July humidity, tend to have higher values of the final principal component measure. Higher values of the climate measure tend to be associated with southern coastal regions such as Alabama and Florida, while lower values tend to be associated with more northern regions such as Maine and Wyoming. Based on the cumulative variance of all six variables explained by the final measure, the climate measure has the strongest performance accounting for 46.2% of the variation.

The developed recreational infrastructure measure is intended to capture the role of amenities that tend to be more artificial, or man-made (table 2). Fourteen separate variables are used to construct this particular amenity attribute measure. Individual variables that determine the final amenity measure include number of park and recreational departments within the county, the number of

Table 1. Principal Component Eigenvectors: Climate

Climate Variables	Eigenvector
Average temperature	0.5016
Average annual precipitation	0.5387
January temperature	0.5160
January sunny days	0.0391
July temperature	0.0747
July humidity	0.4300
Cumulative variance explained	46.17%

Table 2.   Principal   Component   **Eigenvectors:**   Developed   Recreational   **Infrastructure**

Urban Facilities Variables	Eigenvector
# Parks and recreational departments	**0.4168**
# Tour operators and sightseeing tour operators	0.2884
# Playgrounds and recreation centers	0.0187
# Private and public swimming **pools**	0.0785
# Private and public tennis courts	0.4950
# Organized camps	0.2739
# Tourist attractions and historical places	0.1559
# Amusement places	0.3534
# Fairgrounds	0.0035
# Local or county parks	0.0313
# Private and public golf **courses**	0.3908
# **ISTEA** funded **greenway** trails	0.3300
Estimated of acres of urban and built up land from 1995 National Resources Inventory (NRI)	0.0680
Cumulative variance explained	16.69%

Table 3.   Principal Component Eigenvectors: Land

Land Variables	Eigenvector
# Guides services	0.3186
# Hunting/fishing preserves, clubs, lodges	−.0276
BLM public domain acres	0.1593
Acres of mountains	0.4021
Acres of cropland, pasture and range land	−.3403
USDA-F'S national forest and grassland acres	0.4495
FWS refuge acres open for recreation	0.1129
Woodalls # private campground sites	0.2983
Woodalls # public campground sites	0.1449
NPS federal acres	0.2617
NRI estimate of forest acres	0.0981
Acres managed by 'Bureau of Reclamation, Tennessee Valley Authority, Corps **of** Engineers	0.0014
Total rail-trail miles	0.0993
State park acres	0.0420
The Nature Conservancy acres with public access	0.0231
National Wilderness Preservation System acreage: total **1993**	0 . 4 2 4 0
Cumulative variance explained	18.72%

tennis courts, the number of establishments defined as amusement in orientation, and the number of golf courses. The number of swimming pools, playgrounds, and recreational centers and fairgrounds does not contribute significantly to the final developed recreational infrastructure measure of amenities. The central sands region of North Carolina, for example, the location of numerous golfing communities such **as** Pinehurst, scores highly on this amenity measure. Given the nature of most of rural America, the majority of counties score rather low on this measure. Due to the relatively large number of variables introduced into this measure, coupled with the large number of variables not loading into the final principal component measure, only 16.7% of the cumulative variance is explained.

The land measure is intended to **describe** the nature of the terrain and land resources within the county (table *3).* The principal components derived final measure appears to separate mountainous areas that have high

Table **4.** **Principal Componenl Eigenvectors: Wafer**

Water Variables	Eieenvector
# Marinas	0.4219
# Canoe outfitters, rental firms and raft trip firms	0.3269
# Diving instruction or tours and snorkel outfitters	0.1908
# Guides services	0.4776
# Fish camps, private or public fish lakes, piers and ponds	0.5482
# American Whitewater Association total white water river miles	0.1184
Designated Wild & Scenic River miles: Total 1993	0.1367
National Resources Inventory (NRI) acres in water bodies 2–40 acres, < 2 acres, and >= 40 acres (lake or reservoir)	0.1597
NRI acres in streams < 66' wide, 66-660' wide, and >= 1/8 miles wide	–.0364
NRI water body >= 40 acres (bay, gulf, or estuary)	0.2665
NRI wetland acres	0.0654
NRI total river miles, outstanding value	0.1235
Cumulative variance explained	16.84%

Table 5. **Principal Component Eigenvectors: Winter**

Winter Variables	Eigenvector
Cross-country Ski Areas Association # Xcski firms, and public XCski centers	0.3496
International Ski Service Skiable acreage	0.3206
Federal land acres in counties with > 24" annual snowfall	0.5233
Agricultural acres in counties with > 24" annual snowfall	0.1381
Acres of mountains in counties > 24" annual snowfall	0.5864
Acres of forestland in counties > 24" annual snowfall	0.3717
Cumulative variance explained	35.93%

levels of national forest and grassland acres and federally designated wilderness acreage from those that tend to be more agriculturally oriented. Given these results, counties from the western states would tend to score higher on this measure, while lands in the Corn Belt or 'Great Plains would tend to score lower. Again, due to the relatively large number of variables introduced into this measure, coupled with the large number of variables not loading into the final principal component measure, only 18.7% of the cumulative variance is explained.

The water measure is intended to capture the water resources available within the county (table 4). The final principal component measure used for this analysis tends to emphasis value added businesses associated with water resources, Counties with a higher number of marinas, guide services, businesses that cater to fishing activities, and canoe or rafting rental firms tend to score higher on this measure. Counties with undeveloped, water resources do not appear to rank high

in this measure. This measure captures water resources that are more highly developed for recreational uses. The Ozark region of Missouri tends to score high on this measure while more pristine *regions such* as the boundary waters of Minnesota, tend to score lower. Clearly, arid places such as eastern Colorado score the lowest on this measure. As with the developed recreational infrastructure and land measures, the large number of variables introduced into the analysis reduced the cumulative variation explained, to 16.8%.

The fifth and final measure of amenity attributes used in this analysis captures winter recreational opportunities (table 5). Results strongly separate counties with developed commercial facilities, both downhill and cross-country skiing, from areas with limited snowfall or those areas with snowfall that are not developed. This principal component measure is separating winter recreational destination areas, such as Teton

County, Wyoming, from all others. The cumulative variation explained is 35.9 %.

The measures as defined by the principal components analysis appear to be identifying those counties that tend to have reasonably high levels of recreational development combined with an amenity base as opposed to those areas that have solely higher levels of raw amenities. The interpretation of the empirical results in the next section must be sensitive to the fact that the measures developed here tend to capture many of the areas with more highly developed amenities. Remote counties with pristine lakes and untouched wilderness will tend to score lower on several of our measures than would similar counties with more highly developed areas. Moreover, remote areas with lakes, forests, and non-flat terrain will score higher in these measures than remote flatlands regardless of the level of commercial development. One possible explanation for this pattern is the relative homogeneity of most rural counties. Rural counties with high amenities are more commercially developed and so tend to stand out in a statistical sense. From a regional growth perspective, there may be mild agglomeration effects that exist with respect to recreational facility develop ment in rural counties.

Growth Model

As predicted by theory, initial conditions play an important role in determining overall growth levels (table 6). The negative and statistically significant coefficient on initial levels for each respective equation, all else constant, reinforces prior results of the rural renaissance. Counties that had higher levels of population, employment, and per capita income at the beginning of the period (1985) tended to experience lower rates of overall growth and development. Higher initial levels of population appear to lead to higher employment growth while higher initial levels appear to lead to higher growth levels in per capita income. Given these results, the second hypothesis 'laid out above appear to hold true and there appear to be patterns of convergence.

While a detailed discussion of the performance of each individual control variable is beyond the scope of this article, some highlights of the analysis warrant discussion. First, given our simple entropy measure

of income equality, the results suggest that higher levels of income inequality tend to be associated with lower levels of growth in terms of population but the relation to employment and income is unclear. These results, regardless, suggest that rural areas with a widening income gap between the rich and the poor may experience growth difficulties in the future.

Second, development policy often points to the negative influence of local tax burdens, the results of this analysis suggest 'that property taxes are negatively associated with population and income growth. Coupled to the prior result, government expenditures appear to have a positive influence on population growth, but negative on income growth. This latter result is consistent with Bartik who argues that people and firms perform a crude cost-benefit analysis when weighing taxes and services. If services are perceived to be provided in an effective and efficient manner, people and firms are willing to pay higher taxes. Higher taxes in and of themselves may not be sufficient to hinder economic growth and development. The mix between taxes and services is key.

Other interesting results include the strong negative relationship between percent of the population over age sixty-five and growth rates. This result raises a question about the role of retirees in rural economic growth. A higher percent of the population that is nonwhite seems to place downward pressure on population 'and employment growth, but upward pressure on income growth. The income result, coupled with the initial income condition result above, might be due to the lower level of income in these areas to begin with.

Of the five amenity attribute measures, all five appear to play a significant role in regional economic growth. Based *on* the simple reduced form results some strong patterns between amenities and economic development and growth become apparent. Climate appears to strongly influence growth levels in population, have no role in employment growth, and have a weak influence on per capita income growth. Given that the regions with high climate amenity scores tend to also be retirement destination areas, this result seems to make intuitive sense. Similarly, counties with higher levels of water amenities as measured by our simple principal component index also tend to be associated with higher levels of population and

Table 6. Estimation on Reduced Form

	A Population	A Employment	A Per Capita Income
Intercept	52.174	74.102	152.007
	(8.511)	(5.730)	(18.949)
Population in 1985	0.00001	0.000.5	-0.0001
	(0.245)	(4.134)	(-1.468)
Employment in 1985	-.0003	-0.001	0.0006
	(-2.714)	(-3.967)	(3.784)
Per capita income in 1985	-0.0004	-0.001	-0.005
	(-2.425)	(-3.833)	(-24.466)
Percent of nonwhite population	-0.049	-0.080	0.192
	(-2.043)	(-1.593)	(6.118)
Percent of population under seventeen	-0.508	-0.965	-0.170
	(-4.740)	(-4.266)	(-1.214)
Percent of population above sixty-five	-0.345	-1.607	-0.449
	(-8.963)	(-8.081)	(-3.637)
Entropy income distribution index	0.008	0.0004	0.003
	(-4.886)	(0.113)	(1.228)
Household with income under poverty	0.103	-0.154	-0.957
	(0.915)	(-0.648)	(-6.4990)
Unemployment rate	0.182	-0.490	-0.550
	(2.021)	(-2.581)	(-4.671)
Percent high school graduate	0.047	0.185	-0.218
	(1.024)	(1.908)	(-3.629)
Crime rate	0.0005	0.001	-0.0002
	(3.018)	(3.062)	(-0.886)
Number of physicians	-0.004	0.012	0.042
	(-0.970)	(1.393)	(7.572)
Property tax	-0.040	-0.049	-0.061
	(-2.048)	(-1.1%)	(-2.391)
Government expenditure	0.00008	-0.00004	-0.0001
	(3.822)	(-0.910)	(-1.995)
Climate	1.763	0.517	0.478
	(6.824)	(0.948)	(1.415)
Developed recreational infrastructure	0.541	1.308	1.018
	(2.772)	(3.174)	(3.984)
Land	0.854	1.491	-0.136
	(3.407)	(2.820)	(-0.414)
Water	0.432	0.046	1.154
	(1.951)	(0.099)	(3.984)
Winter	1.148	1.560	1.039
	(4.003)	(2.578)	(2.768)
N≈	2243	2243	2243
F statistic =	48.491	22.817	67.781
Adjusted R^2 =	0.287	0.156	0.3614

income growth, but water amenities do not appear to influence job growth directly. These results might be capturing retirement migration, the growth in recreational demand for natural resource amenities, or higher end residential areas within the commuting shed of urban areas.

Developed recreational infrastructure is strongly associated with population, employment, and income growth rates. Recall that the index is driven by availability of parks, tennis courts, and golf courses, among other things. Given that this measure appears to be identifying a certain type of higher end resort-type community, the demand for more modest paying service jobs may be high, but workers may be precluded from locating in the area itself. Because these amenity attributes can be directly affected by policy, particular attention should be paid to these findings.

The positive relationship between land amenities and employment and population growth rates appears to be somewhat reflective of the growth of tourist economies around publicly owned land resources (e.g., national forests) and mountainous areas. In addition, the negative loading factor on the amount of land that could be described as more traditional agriculture suggests that the ·model is capturing the continued economic difficulties agriculturally dependent areas are experiencing.

The final amenity measure, attributes that support winter recreational activities, is positively related to growth rates in population, employment, and per capita income. Demand for winter recreational activities such as skiing (downhill and cross-country) and/or snowmobiling have been and are expected to continue growing. Further, the same resources (slopes, lifts, and trails) are increasingly being used to support "off season" activities such as mountain biking, hiking, and horseback riding. The implication of 'this result is that rural areas that can take advantage of these combinations of natural and developed resources are in a position to expand their local economy.

Of particular interest is the general conclusion that all statistically significant amenity attributes are positively related to economic growth. Not a single statistically significant negative coefficient was uncovered. In particular, the concern expressed'about the quality of jobs created, as measured by changes in per capita income, appears to be misplaced. In light of the theoretical result of Roback predicting a negative capitalization of amenities into wages, this latter result may be explained in part by differences in wages and non-wage income and suggests future directions of analysis. Given these consistent findings, there is significant evidence to conclude that the third and central hypothesis laid out above appears to hold true.

Conclusions and Policy Implications

As the demand for natural resource amenity attributes increases, many rural areas of the United States are in a position to capitalize economically on available resource endowments While the rural growth and natural resource management literature have acknowledged the importance of amenity attributes in economic performance and

more widely quality of life in general, the nature of the linkage is not well understood. Empjrjcal studies attempting to quantify the linkage have tended to view amenjties in a narrow way, often times limited to single dimensional measures of a region's climate. More recent work has tried to move beyond this uni-dimensional approach and to view amenities as multi-faceted and interconnected. This study builds on the most recent literature by building comprehensive measures of multi-dimensional natural resource amenity and quality of life attributes within the framework of a rigorous theoretical and empirical model of regional economic growth.

The results of this modeling effort are encouragmg. The empirical model lends insights into the influence of a range of factors including property tax burdens, age and income distributions, and education levels, among others, on regional economic growth. More importantly, the. model reported here provides more detailed insights into the role of natural resource amenity attributes in fostering regional economic growth. As hypothesized, the empirical results provide strong evidence that rural areas which can be characterized as endowed with high levels of key natural resource amenity endowments and overall quality of life experience higher overall levels of growth. Of the five amenity attributes included in our models, all are positively related to at least one measure of growth; none were negatively related to any of the measures of growth.

The policy implication appears to be simple and straightforward. Rural areas endowed with key natural resource amenities can manage those resources to capture growth *more* effectively. This may entail expansion beyond policies that have historically been focused on extraction of the resource base. Given the expected levels of growth in the demand for recreational uses of these resources, the future growth and development potential of many rural areas may be additionally tied to a range of tourism activities.

'This study moves the literature one step closer to better understanding the linkage between natural amenities, quality of life, and development, but it does not provide definitive policy answers. For example, the method in which we construct our amenity measures, while more comprehensive than the current literature, falls short of capturing any agglomeration effects that may exist across amenity

types. Similarly, our amenity measures did not account for any spatial effects across county lines. In addition, the analysis does not offer any advice to those rural areas that may be said to be "amenity poor."

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References

Andrews, EM. "Comparative Studies of Life Quality: Comments on the Current State of the Art and Some Issues for Future Research." *The Quality of Life: Comparative Studies.* A. Szalai and EM. Andrews, ed. Newbury Park CA: SAGE, 1980.

Barkley, D.L., M.S. Henry, and S. Bao. "The Role of Local School Quality and Rural Employment and Population Growth." *Rev. Regnl. Stud.* 28(Summer, 1998):81–102.

Bartik, T.J. *Who Benefits for Stare and Local Economic Development Policies?* Kalamazoo Ml: W.E. Upjohn Institute, 1991.

Beale, CL, and K.M. Johnson. "The Identification of Recreational Counties in Nonmetropolitan Area of the USA." *Pop. Res. Policy Rev.* 17(1998):37–53.

Blanchflower, D.G., and AJ. Oswald. *The Wage Curve.* Cambridge MA: MIT Press, 1996.

Boarnet, M.G. "An Empirical Model, Intrametropolitan Population and Employment Growth." *Pap. Regnl.* Sci 73(April 1994): 135-153.

Carlino, G.A., and E.S. Mills. "The Determinants of County Growth." *J. Regl.* Sci 27(February 1987):39–54.

Deller, S.C., and T.S. Tsai. "An Examination of the Wage Curve: A Research Note." *J. Regl. Anal. Policy 28,* no. 2(1999):3–12.

Dissart, J.C., and S.C. Deller. "Quality of Life in the Planning Literature." *J. Planning Lit.* 15(August 2000):135–61.

Dorf, R.J., and M.J. Emerson. "Determinants of Manufacturing Plant Location for Nonmetropolitan Communities in the West North Central Region of the U.S." *J. Regl. Sci.* 18(April 1978):109–20.

Duffy, N.E. "The Determinants of State Manufacturing Growth Rates: A Two-Digit-Level Analysis." *J. Regl. Sci.* 34(May 1994):137–62.

Duffy-Deno, K.T. "The Effect of Federal Wilderness on County. Growth in the Intermountain Western United States." *J. Regl. Sci.* 38(February 1998):109–36.

English, D.B.K., D.W. Marcouiller, and H.K. Cordell. "Linking Local Amenities with Rural Tourism Incidence: Estimates and Effects." *Soc. Natur. Resour. 13.* no. 3(2000):185–202.

Fulton, J.A., G.LV. Fuguitt, and R.M. Gibson. "Recent Changes in Metropolitan–Nonmetrobreak politan Migration Streams." *Rural* Sociology 62(Fall 1997):363–84.

Gottlieb, P.D. "Amenities as an Economic Development Tool: Is There Enough Evidence?" *Econ. Develop. Quart.* 8(August 1994):270–85.

Graves, P.E. "A Life-Cycle Empirical Analysis of Migration and Climate, by Race." *J. Urban Econ.* 6(1979):135–47.

——. "Migration and Climate." *J. Regl. Sci.* 20(May 1980):227–37.

——, "Migration with a Composite Amenity: the Role of Rents." *J. Regl.* Sci. 23(November 1983):541–46.

Greenwood, M.J. "Human ·Migration: Theory, Models, and Empirical Studies." *J. Regl.* Sci. 25(November 1985):521–44.

Halstead, J.M., and S.C. Deller. "Public Infrastructure in Economic Development and Growth: Evidence from Rural Manufacturers." *J. Community Develop. Soc. 28,* no. 2(1997):149–69.

Henry, M.S., D.L. Barkley, and S. Bao. "The Hinterland's Stake in Metropolitan Growth: Evidence from Selected Southern Regions"' *J. Regl. Sci* 37(August 1997):479–501.

Henry, MS., B. Schmitt, K. Kristensen, D.L. Barkley, and S. Bao. "Extending Carlino–Mills Models to Examine Urban Size and Growth Impacts on Proximate Rural Areas.*' Growth and Change* 30(Summer 1999):526–48.

Howe, J., E. McMahon, and L. Propst. *Balancing Nature and Commerce in Gateway Communities.* Island Press, 1997.

Kusmin, L.D. *Factors Associated with the Growth of Local and Regional Economics: A Review of Selected Empirical Literature.* Washington DC: U.S. Department of Agriculture, ERS, March 1994.

Marcouiller, D.W. "Environmental Resources as Latent Primary Factors of Production in Tourism: The Case of Forest-Based Commercial Recreation." *Tourism Econ. 4,* no. 2 (1998):131–45.

Marcouiller, D.W., and S.C. Deller. "Natural Resource Stocks, Flows and Regional Economic Change: Seeing the Forests and the. Trees." *J. Regl. Anal. Policy 26,* no. 2 (1996):95–114.

Miller, R.E. "A Taxonomy of Nebraska County Economies: an Application of the Optimization Approach to Identifying a

System of Regions." *J. Regl. Sci.* 16(May 1976):225–35.

Mills, E.S. "The Location of Economic Activity in Rural and Nonmetropolitan United States." *The Changing American Countryside: Rural People and Places.* E.N. Castle, ed. Lawrence KS: University of Kansas Press, 1995.

Nord, M., and J.B. Cromartie. "Migration: the Increasing Importance of Rural Natural Amenities." *Choices* (Third Quarter 1997):31–32.

Porell, F.W. "Intermetropolitan Migration and Quality of Life." *J. Regl. Sci.* 22(May 1982): 137-58.

Roback, J. "Wages, Rents, and the Quality of Life." *J. Politi. Econ.* YO(December 1982):1257–77.

——. "Wages, Rents, and Amenities: Differences Among Workers and Regions." *Econ. Inquiry* 26(January 1988):23–41.

Rudzitis, G. "Amenities Increasingly Draw People to the Rural West." *Rural 'Develop. Perspect.* 14(August 1999):23–28.

Steinnes, D., and W. Fisher. "An Econometric Model of Intraurban Location." *J. Regl.* Sci. 14(April 1974):65–80.

US. Department of Agriculture. "Nonmetro Population Growth Rebound of the 1990's Continues, but at a Slower Recent Rate." Rural *Conditions and Trends* 8(October 1997):46–51.

Wagner, J.E., and S.C. Deller. "Measuring the Effects of Economic Diversity on Growth and Stability." *Land Econ.* 74(November 1998):541–56.

Walzer, N., and S.C. Deller. "Rural Issues and Trends: Role of Visioning Programs." *Community Visioning Programs: Practices and Experiences:.* N. Walter, ed. New York: Praeger 1996.

Appendix A: Sample Descriptive statistics

	Mean	Standard Deviation
Growth rate population 1985-95	3.023	13.964
Growth rate employment 1985–95	14.214	26.689
Growth rate per capita income 1985–95	57.141	19.106
Population in 1985	23,100.13	29,040.46
Employment in 1985		
Per capita income 1985	17,014.87	20,290.46
Percent of nonwhite population	12.293	16.549
Percent of population above seventeen	27.166	3.603
Percent of population above sixty-five	15.861	4.272
Entropy income distribution index	2408.16	429.635
Households with income under poverty	14.454	7.148
Unemployment rate	7.39s	3.532
Percent high school graduate	67.697	10.398
Crime rate	2409.61	1911.37
Number of physicians	71.601	69.235
Property tax	82.77	16.34
Government expenditure	29,582.19	34,463.06
Climate	0.0	1.675
Land		.1.473
Developed recreational infrastructure,	0.0	1.731
Water	0.0	1.422
Winter	0.0	1.469