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Population Growth in High Amenity Nonmetropolitan Areas: What's the Prognosis?

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Abstract. This paper examines the continued strong population growth in U.S. nonmetropolitan areas possessing high levels of natural amenities during the 1990s and the potential reasons for convergence of population growth across the top tiers of the amenity hierarchy. Based on an examination of spatial hedonic growth regressions, it is concluded that strong demand for high amenity areas continued in the 1990s, but the convergence in population growth across the top tiers was related to convergence in quality of life and lower productivity growth in the highest amenity tier counties, not inelasticity in the supply of land and housing. The results suggest continued convergence in population growth in the near future and further suggest that local policymakers in the most amenity attractive areas should focus on protecting and enhancing valued local area natural characteristics; failure to do so will lead to a lower local quality of life and stagnation of area economic growth.

Keywords: Natural amenities; Regional population growth; Quality of life

1. Introduction

Fast population growth in high amenity U.S. nonmetropolitan areas has been widely documented. The quality of life available in high amenity areas attracts both working-age adults and retirees (e.g., Vias, 1999; Deller et al., 2001; Gunderson, Pinto and Williams, 2008; Poudyal, Hodges and Cordell, 2008). Increased numbers of working-age adults shifts labor supply outwards, while retiree spending causes an outward shift in labor demand. Favorable climate and natural amenities particularly may attract those with greater human capital, further boosting growth (McGranahan and Wojan, 2007). High amenity areas similarly experience growth in tourism because of the greater availability of outdoor activities (Deller et al., 2001; Lewis, Hunt and Plantinga, 2002; Monchuk et al, 2006). Continued increases in consumption demand for amenities and recreational activities, fueled by rising income, increased wealth and aging of the population, could be expected to be the engine of future growth in high-amenity areas (Rappaport, 2007).

Yet, numerous potential congestion forces exist in high-amenity areas which could hinder or completely choke off growth. Primarily, the natural attributes which make the area attractive to begin with require protection (Rudzitis, 1999; Rasker and Hansen, 2000; Hansen et al., 2002; Poudyal, Hodges and Cordell, 2008). Increased pollution and traffic congestion in fast-growing states have been reported as reducing the quality of life (Gabriel, Mattey and Wascher, 2003), which would be expected to subsequently reduce growth through lower in-migration.

In addition, increased land costs can reduce the economic viability of the area for firms and households. Profits of industries such as manufacturing, which does not depend on local demand but does require local land as an input in production (Henderson and McDaniel, 2005), are adversely affected by rising land costs. Cromartie and Warmwell (1999) speculate that rising local costs of living, such as housing costs, led to the convergence of net migration rates across amenity quartiles of counties in the West during the 1990s, in which the highest net migration rate occurred in the second highest amenity quartile. Additional evidence was provided by increased in-migration to lower-tiered amenity areas in the Great Plains (Cromartie, 1998) and reduced in-migration into the most scenic U.S. rural areas (McGranahan, 2008). To be sure, Glaeser and Tobio (2008) conclude that faster growth in housing supply in the South was a more important source of growth in the U.S. South near the end of the previous century than increased demand for favorable weather.

Therefore, in this paper we compare recent economic trends in high amenity U.S. nonmetropolitan counties with those in other nonmetropolitan counties further down the amenity spectrum. We first examine patterns in income, population and housing price growth in the 1990s within the context of a spatial hedonic framework. In this framework, declining relative real incomes in the highest amenity areas are interpreted as the result of some combination of increased quality of life in the area and general increased demand for amenities. Elastic housing supply would be suggested by rapid population growth but declines in housing prices, while inelastic housing supply would be suggested by the opposite pattern. We then examine population growth for the 2000-2008 period. Areas experiencing significant congestion costs during the 1990s would be expected to suffer from even more relative sluggish population growth in the current decade.

A review of the literature to motivate the empirical analysis follows in the next section. This is followed by a description of the empirical approach in Section 3. Section 4 presents and discusses our results. Among our primary findings, convergence in population growth across the top amenity tiers was related to convergence in quality of life and lower productivity growth in the top amenity tier counties, not inelasticity in the supply of land and housing. Conclusions and prognosis for the future of high amenity areas then follow in the last section of the paper. The primary policy prescription of the study is the need to protect the valued attributes of high amenity areas to preserve the quality of life. Allowing present growth to reduce the quality of life ultimately will lead to lower future growth.

2. Theoretical Motivation

Natural amenities can be thought of as the physical and ecological characteristics of an area that make it attractive, which include "terrestrial and aquatic landscapes, distinguishing topographical features, climate, air, water and biodiversity quality and quantity" (Moss, 2006, p. 8). Natural amenities provide non-pecuniary utility to households, making high-amenity areas more desirable places to live and visit. Not surprisingly then, natural amenities have played an important role in regional growth processes within the United States.

Rappaport (2007) reports that nice weather became increasingly important as a determinant of internal migration flows over the twentieth century. While considering a number of possible reasons, such as advances in heating and cooling technologies, he concludes that the increased importance can be attributed to rising U.S. income and wealth, which increases the demand for amenity consumption as a normal good. Hedonic studies similarly report a significant increase in valuation of the contribution of weather to perceived quality of life by U.S. households (Cragg and Kahn, 1999; Costa and Kahn, 2003).

In an analysis of the 1970s and 1980s, Greenwood et al. (1991) report persistent non-economic net in-migration to states which are classified as amenity attractive according to the hedonic study of Blomquist, Berger and Hoehn (1988). Deller et al. (2001) find climate and water amenities to be strongly related to population growth, weakly related to per capita income growth, and unrelated to employment growth. Monchuk et al. (2006) find that counties with higher initial levels of outdoor amenities experience greater growth in total personal income. Lewis, Hunt, and Plantinga (2002) report the percentage of land having some conservation status among Northern Forest region counties as being associated with higher net in-migration, and indirectly then employment growth.

Vias (1999) reports the importance of natural amenities for population and employment growth in the Rocky Mountain West. Rasker and Hansen (2000) similarly report amenity variables as being associated with significantly greater rural population growth in Idaho, Montana, and Wyoming. Gunderson, Pinto and Williams (2008) report the existence of amenity-based migration in areas of Arizona, Colorado, New Mexico, and Utah.

Beyond the general effect of jobs following people, amenities may spur additional growth if the migrants to these areas possess above-average levels of human capital. Along these lines, McGranahan and Wojan (2007) find that households with higher levels of human capital were attracted to high amenity areas, particularly to mountainous counties, counties with a mix of forest and nonagricultural open areas, and counties with sunny winters. They further find that such migration provided a boost to employment growth beyond the general migration effect.

Other studies suggest the existence of congestion forces which could reduce relative economic growth in high-amenity areas. For one, rising housing costs have been suggested as the primary culprit for the relative slowing of growth in areas with the highest levels of natural amenities (Cromartie (1998; Cromartie and Warmwell, 1999; McGranahan, 2008). Henderson and McDaniel (2005) find amenities positively influencing service sector and retail employment, but not employment in manufacturing, for which, along with weak local demand, higher land costs and more restrictive zoning on land for manufacturing are suggested as possible causes.

Land supply may be limited in high amenity areas because of the existence of public lands, zoning restrictions, or purchases of land by nonprofit organizations (McGranahan, 2008). Other congestion forces such as increased pollution and longer traffic commutes also can arise (Hansen et al., 2002; Gabriel, Mattey and Wascher, 2003), while growth-induced reductions in valued attributes such as open space (Kahn, 2001; Cho, Poudyal and Roberts, 2008), wildlife (Hansen et al., 2002), the quantity or quality of vegetation and forests (Sengupta and Osgood, 2003; Cho et al., 2009), or scenic views (Benson et al., 1998) also may occur.

Like rising land prices, reduction in the quality of life reduces relative growth. However, according to the spatial hedonic framework the pattern of factor price and population growth differs depending on the source of congestion. Reduced quality of life shows up as increased real wages to households to compensate them for the lower quality of life (Gabriel, Mattey and Wascher, 2003). In this case, population growth also would be sluggish. In contrast, an area increasingly viewed as desirable because of increased amenity demand would experience falling relative real wages and faster population growth (Rappaport, 2007, Glaeser and Tobio, 2008).

The elasticity of housing supply will affect how much population growth accompanies an increase in demand for amenities. Less elastic housing supply would be associated with relatively stronger growth in housing prices and lower population growth (Glaeser and Tobio, 2008). Besides changes in amenity demand and housing supply, a third potential source of differential population change is relative growth in productivity. A reduction in productivity would reduce both wages and housing prices, while also reducing population growth (Gabriel and Rosenthal, 2004 Glaeser and Tobio, 2008). Thus, changes in real wage rates distinguish whether slowing growth in high-amenity areas is simply attributable to higher housing prices or also to deterioration in the quality of life and slower productivity growth.

3. Empirical Model

We compare 1990s growth in population, median household earnings, and median housing costs for nonmetropolitan counties across the amenity hierarchy.[1] The definition of the amenity hierarchy corresponds to the wide used amenity ranking produced by the Economic Research Service of the U.S. Department of Agriculture (McGranahan, 1999). The ranking is based on an amenity-scale derived from a combination of six measures: (1) average January temperature; (2) average January days of sun; (3) a measure of temperate summers; (4) average July humidity; (5) topographic variation; and (6) water area as a proportion of total county area. The ranking ranges from a value of 1 for the least amenity-attractive areas to 7 for the most amenity-attractive areas. Among the six indictors, topographic variation is most correlated with the ranking, followed by temperate summer and low July humidity (McGranahan, 1999). Although other natural attributes not included in the ranking may affect the amenity attractiveness of an area, it provides a constant, exogenous ranking over time.[2]

As shown in Table 1, in going from lowest to highest rank there are 8, 310, 816, 614, 169, 62 and 19 counties in each of the categories. The vast majority of counties with rank 5 or higher are located in the U.S. Census West Region, including all counties with rank 7. Among the 310 counties with rank 2, 290 of them are in the Midwest Region. All counties with rank 1 are in the Northeast Region.[3]

[1] We use the 2003 U.S. Bureau of Census definition of metropolitan and nonmetropolitan counties throughout the empirical analysis, which is based on reported population from the 2000 Census of Population and Housing. This allows us to compare growth patterns for the same counties across decades.

[2] As discussed by McGranahan (1999), twelve indicators were originally considered in the construction of the ranking scale. However, for example, land in forest was not related to population change, either alone, or in conjunction with the other indicators, and was omitted from consideration.

[3] Following the U.S. Bureau of Economic Analysis, there are cases where independent cities in Virginia are merged with the surrounding county to form a more functional region. For each merged area, the average rank was computed and rounded to the nearest integer rank.

Because the ranking is based on exogenous weather and natural attributes of the area, it is constant across time. Thus, a potential problem with hedonic studies, endogeneity of characteristics used as explanatory variables, is avoided (Cho et al., 2009). Yet, the quality of life in the area can vary over time depending on aforementioned congestion forces such as length of traffic commutes, pollution, or quality of the natural environment, and should be reflected in our measure of real wages obtained from the hedonic regressions (Gabriel, Mattey and Wascher, 2003).

In our base model, we regress natural log-differences in population, median household earnings, and median monthly housing costs on a vector of dummy variables indicating the amenity rank of the county (*AMEN_RANK*):

(1) $\log(Pop00)-\log(Pop90) = \alpha_P + B_P(AMEN\_RANK) + \varepsilon_P$,

(2) $\log(Earn00)-\log(Earn90) = \alpha_W + B_W(AMEN\_RANK) + \varepsilon_W$,

(3) $\log(HCost00)-\log(HCost90) = \alpha_H + B_H(AMEN\_RANK) + \varepsilon_H$,

where α_P, α_W, α_H are constants; B_P, B_W, and B_H represent coefficient vectors corresponding to the vector of dummy variables for amenity ranking (omitting rank=1 to avoid perfect collinearity); while ε_P, ε_W, and ε_H are stochastic terms. Because of the paucity of microdata for small rural counties, aggregate data from the 1990 and 2000 U.S. Census of Population and Housing SF3 files are used to measure the three dependent variables (Hanson, 2005; Partridge et al., 2009).

Earn00 and *Earn90* represent median household earnings for employed residents in the county for 1990 and 2000, respectively. Median earnings have advantages over other possible measures of income in the hedonic framework. For example, per-capita income does not conform to the notion of labor earnings in the hedonic model because it includes capital income. Besides not representing the median worker, the average wage per job in the county could be greatly skewed, especially in rural areas with seasonal and part-time work; the mean wage measure would regard a person working one full-time job and two infrequent part-time jobs as having three unique jobs, which would likely result in a relatively low average wage for each job. Finally, housing purchases are household decisions and therefore reflect the purchasing power of a household, not the wage rate of the average worker.

We also use median costs for housing, which have the same advantages outlined above for median income. Our variable *HCost* is defined as the weighted average median gross rent ($ per month) of owner and renter-occupied housing units (Gabriel, Mattey and Wascher, 2003). For owner-occupied units, median housing prices are converted into imputed annual rent using Peiser and Smith's (1985) discount rate of 7.85% as used in other hedonic studies (Gabriel and Rosenthal, 2004; Partridge et al., 2009). The monthly average of this amount along with the median monthly rent for occupied rental units, weighted by the shares of owner- and renter-occupied houses, is our median housing cost variable. As discussed in the next section, regional housing cost differences are assumed to primarily reflect differences in land values (Davis and Palumbo, 2006).

In sensitivity analysis we also include a vector of log-differences of demographic (*Demog*) characteristics in Equation (2) and a vector of log-differences of housing characteristics (*HChar*) in Equation (3). Inclusion of these variables attempts to control for changes in earnings and housing costs which occur because of the change in composition of households and housing. However, because they are aggregate measures and not characteristics of micro units they may be endogenous, which would bias the estimated coefficients (Hanson, 2005). Thus, these variables only are used to assess the robustness of the base model results.

4. Results and Discussion

The results for the base regressions are shown in columns (1)-(3) in Table 2. Columns (4) and (5) show the results of sensitivity analysis when demographic and housing characteristics are added to the respective earnings and housing cost equations. Below each coefficient in parentheses are Huber-White heteroscedasticity-consistent standard errors.[4]

4.1 Regression Results

As shown in Table 2, all three regressions represent a significant fit of the data. Except in the housing cost equation, most variables are individually statistically significant below the 0.01 significance level. Each coefficient is interpreted as the log point change (i.e., approximately the percentage change) in the dependent variable for having the respective amenity rank relative to the omitted category rank of 1, which is reflected by the constant.

Population growth was greater the higher the amenity ranking, except for the highest-ranked amenity counties which had slightly lower growth than counties in the next lower amenity tier. The bottom tier counties experienced population decline over the decade. The general positive relationship between amenities and population growth confirms the consensus of findings in the literature discussed in Section 2. Growth in the highest amenity tier somewhat falling below that in the next highest tier also comports with other reports in the literature (Cromartie, 1998; Cromartie and Warmwell, 1999; McGranahan, 2008).

Examination of the earnings and housing cost regressions provides insights into the sources of the population growth pattern across the amenity hierarchy. As shown in column (2), (nominal) earnings growth is weaker the farther up the county is in the amenity hierarchy. Only earnings growth in the second lowest amenity tier is not statistically lower than earnings growth in the lowest tier. Stronger population growth combined with earnings reduction suggests

[4] Because our primary focus is on the point estimates of the amenity rank variables, not their individual statistical significance for hypothesis testing, other possible adjustments of the standard errors, such as the approach by Conley (1999) to account for potential spatial autocorrelation were not considered. The Conley procedure is equivalent to the Huber-White correction in the absence of distance weighting of the errors. Also, the spatial lag model is not used because the counties which are geographically clustered typically have the same amenity ranking.

increased amenity demand over the decade, but this cannot be confirmed without also considering housing costs.

Although the housing cost regression is statistically significant, only the coefficient for the second-lowest amenity tier is individually statistically significant. This pattern suggests the likelihood of multicollinearity in housing cost growth among the amenity tiers. To be sure, based on a 0.01 significance level, a Wald test rejects the equality of amenity rank 2 through amenity rank 7 coefficients, as well as the equality of rank 3 through rank 7 coefficients.

Stronger growth in housing prices combined with earnings declines in higher amenity areas indicate relative real wage declines, revealing increased amenity demand. Yet, slower population growth in the highest amenity tier counties compared to the next tier counties, combined with slower housing price appreciation, suggests the potential existence of corresponding lower productivity growth.

As shown in columns (4) and (5), the general patterns of growth in household earnings and housing costs are not greatly altered by the inclusion of log-differences of demographic characteristics and log-differences of housing characteristics.[5] Each group of characteristics is jointly significant based on F-tests, while the overall regression fits remain statistically significant. Earnings growth remains weaker as a county moves up the amenity hierarchy, while housing price growth remains stronger in the second highest amenity tier than in the highest amenity tier. The similarities in the patterns of results suggest that the base models results are not sensitive to the omission of household and housing characteristics, and their inclusion does not appear to cause noticeable bias in the amenity rank coefficients, suggesting the absence of endogeneity in the characteristics.

4.2 *Sources of Growth*

[5]Demographic characteristics include five ethnicity-share variables, six age-share variables, four educational attainment-share variables, and the percent female among the population. Housing characteristics included age and age squared of the housing unit, housing shares of 1-5 bedroom units, the share of housing comprised of mobile home units, the share of housing with complete plumbing and the share of housing with complete kitchen facilities.

To better understand the sources of differential population growth we impose structure derived from spatial hedonic theory on the reduced-form regression coefficients shown in columns (1)-(3) of Table 2. First, using the standard assumptions of the spatial hedonic model, increased amenity demand is evidenced by relative decreases in real wages in high amenity areas (Blomquist, Berger and Hoehn, 1988; Gabriel, Mattey and Washer, 2003; Gabriel and Rosenthal, 2004); area amenity demand depends on overall amenity demand nationally and the quality of life available in the local area. The negative of the relative real wage change for each amenity tier represents the corresponding relative increase in amenity demand, which in our empirical model equals αB_H-B_W, where α denotes the share of the household budget spent on housing. Implicit in this formulation from spatial hedonic theory is that a traded good exists in which the price is normalized to equal unity across the nation and housing is the only local good whose price may vary geographically.

Calculated relative changes in amenity demand using the above formula are shown in column (1) of Table 3. We see from these calculations that there was increased demand for amenities in the 1990s, as the real wage households were willing to forego to live in a high amenity area increased.[6] However, the margin of difference narrows, nearly converging, across the top three amenity tiers. This suggests convergence of the quality of life across the top three tiers. Convergence of quality of life in the top three tiers could explain the convergence of their population growth and strongest growth in the second highest amenity tier reported above, and the somewhat weaker correlation of the six indicators with population growth for 1990-1996 relative to that for 1970-1996 reported by McGranahan (1999).[7] Thus, perhaps as reported by

[6]The housing budget share is calculated from Census 2000 SF3 data to equal 0.23: [owner-occupied share of housing units*median owner occupied expenses share of household budget for those with a mortgage] + [renter-occupied share of housing units* median gross rental expenses share of the household budget]. Davis and Orthalo-Magne (2007) provide evidence that the housing share of consumption does not vary much geographically or temporally.

[7]Using the same classification of nonmetropolitan counties as in Table 2, a regression of 1980s population growth against a series of dummy variables representing the amenity hierarchy reveals higher growth the higher the amenity rank of the county (shown later in Table 5), in which, except a dip in growth rates in moving from amenity rank 1 counties to amenity rank 2 counties, the growth rate increased fairly linearly in moving up the amenity hierarchy.

Gabriel, Mattey and Wascher (2003) for U.S. states, faster growth in high amenity counties led to traffic congestion and increased pollution, reducing the quality of life and requiring higher real wages as compensation than otherwise would have been expected based on their natural attributes. Quality of life also may have been affected adversely by growth-induced losses of the aforementioned valued natural attributes of the areas: open space (Kahn, 2001; Cho, Poudyal and Roberts, 2008), wildlife (Hansen et al., 2002), forests and other vegetation (Sengupta and Osgood, 2003; Cho et al., 2009), or scenic views (Benson et al., 1998).

Yet, although slight, because amenity demand was strongest in the top tier counties, other forces must underlie lower population growth in the top amenity tier counties relative to second-tier counties. The two remaining possibilities suggested by the hedonic literature are differences in productivity growth and in the elasticity of land and housing supply. Relatively lower productivity leads to lower relative growth in profitability and production by firms. Similarly, lower growth in land supply causes increases in housing prices and firm costs, reducing both the growth in the number of households and firms.

Deriving estimates of relative productivity growth and housing supply across the amenity hierarchy requires assumptions on production of the traded good and housing. For this, we rely on the spatial hedonic growth model of Glaeser and Tobio (2008). In their model, production is governed by a constant-returns-to-scale Cobb-Douglas production function with mobile labor, mobile capital, and land. Productivity growth is based on Hicks-neutral technological shifts. Housing supply is given by the availability of land (L) and building height (h) as $c_o h^{\delta} L$, where c_o is a constant (shifter), and δ reflects the elasticity of housing supply for a given quantity of land. In terms of equilibrium conditions, there are zero economic profits in both production of the traded good and local housing, while full employment of labor and land is assumed.

A Cobb-Douglas utility function also is specified across a nationally-traded good and local housing. Amenity attractiveness of an area serves as a utility function shifter. The amenity shifter relates both to the local qualify of life and the overall demand for amenities nationally, which is influenced by income, wealth and life-cycle considerations.

Glaeser and Tobio (2008) transform the static hedonic model into a growth context by adding innovations in the shifters for amenity demand, productivity, and the supply of land, and by assuming these innovations cause the economy to continually transition from one spatial equilibrium to another. Three growth equations result, which provide structure for interpretation of the results for Equations (1)-(3). The model is more general than the standard hedonic model (e.g., Blomquist, Berger and Hoehn, 1988) because of the allowance for different elasticities of land and housing supply across areas.

The growth equations, along with estimated coefficients from Equations (1)-(3), can be used to estimate the innovations in amenity demand, productivity, and the supply of land. Consistent with the general hedonic literature and as discussed above, increased amenity demand in this model is given by (αB_H-B_W), in which we use the estimate of α from our data (see footnote 6). The model predicts productivity growth as ($(1-\gamma-\beta)B_P+(1-\gamma)B_W$), where β and γ are the Cobb-Douglas shares of labor and capital in production; because of constant returns to scale ($1-\gamma-\beta$) equals the land share of traded good production . Strong population growth combined with wage growth is evidence of relative productivity gains. Amenity-driven population growth would instead be associated with relatively lower wage gains. Housing supply growth is given by ($B_P+ B_W-(\delta B_H/(\delta-1))$). Following Glaeser and Tobio (2008), we use the following production parameter values: γ=0.3, β=0.6 and δ=1.5.

As shown in column (2) of Table 3, productivity growth generally is weaker farther up the amenity hierarchy. The results suggest that counties which cannot rely on natural amenities for growth implement the most pro-business policies. Lower productivity growth in the highest amenity counties also may have resulted from declines in traditional resource-based industries (Power, 1991; Vias, 1999). The lower productivity result is inconsistent with the attraction of amenities for members of footloose professional occupations with higher human capital (McGranahan and Wojan, 2007) as also (on balance) increasing relative productivity growth in the area.

From column (3) it can be seen that restrictions on land supply did not primarily underlie the weaker population growth in the top tier counties relative to the second tier counties. In fact, land supply slightly increased in the top tier counties relative to those in the next two lower amenity tiers. It increased the most in counties with an amenity rank of 4.

Thus, it primarily was lower productivity growth which caused population growth to be lower in top tier counties relative to second tier counties, not the housing sector. To be sure, the multiplier effect of innovations in productivity growth on population growth is much larger than that for land supply because of its small factor share in production and small fraction of household spending (Glaeser and Tobio, 2008). In comparing the top two amenity tiers of counties, the relatively lower land supply response in amenity rank 6 counties had less negative impact on population growth than relatively lower productivity growth in top tier counties.

Columns (4)-(6) of Table 3 show the innovation decomposition using the estimated regression coefficients from columns (4) and (5) in Table 2, while continuing to use the column (1) population regression coefficients. The general pattern follows that reported in columns (1)-(3). One modest change is that amenity demand is now estimated to somewhat more clearly increase the most in the top tier amenity counties, now showing convergence across amenity rank 5 and 6 counties. Productivity growth is weakest and land supply increases the most in the top tier counties.

4.3 Robustness of Results

To further assess the robustness of our results we conduct additional sensitivity analysis. First, because prices of locally produced non-housing goods also may differentially change, we follow Shapiro (2006) and conduct sensitivity analysis using an upper bound of 0.32 for the housing price budget share (α) used to deflate nominal wages. Shapiro derives the upper bound from an estimated relationship between monthly housing rental (including imputed) costs and the overall price index to account for changes in non-housing local goods costs. Second, we consider whether the results are influenced by the remoteness of amenity attractive areas, in which it may be remoteness which underlies lower productivity growth in high amenity areas. Third, we re-estimate the regressions controlling for Census region in an attempt to separate broad regional influences from area-amenity effects.

The results in column (1) of Table 4 indicate that the estimates of amenity demand growth are not very sensitive to reasonable changes in the housing budget share used to deflate nominal earnings. The increase in amenity demand becomes equalized across the top two amenity tiers, providing additional evidence of relative deterioration in the quality of life in the top tier counties. Calculations of innovations in productivity and land supply shown in Table 3 are not affected by choice of deflator for nominal earnings and are not repeated in Table 4. Only the relative multiplier effects of the innovations on population growth would be affected by the different value for α.

Columns (2)-(4) show the results obtained when a variable representing the distance of the county to the nearest metropolitan area is added to all three regressions. The results are essentially unchanged from those reported in Table 3. Although the remoteness variable was statistically significant in all three regressions (not shown), the correlation between remoteness and the amenity rank was 0.03, indicating the amenity rank regression results are not an artifact of differences in remoteness.

Finally, columns (5)-(7) of Table 4 show estimates of innovations in the three sources of growth when controlling for the major Census region: Northeast, Midwest, South, and West. This controls for broad region trends such as for productivity or for housing supply (Glaeser and Tobio, 2008). Yet, because weather indicators are related to Census region, it may be impossible to separate amenity demand from Census region. So, these results are better interpreted as within region analysis rather than as superior to the base model results. For example, Partridge et al. (2008) report cold January weather as negatively influencing growth across broad regions of the country, but within the upper Midwest region, counties with colder January weather and more snow grow faster (ceteris paribus) than other counties in the region because of increased availability of outdoor recreation activities. Similarly, they find larger growth effects for recreational access to water in broad regions where it is scarce.

The results in Table 4 suggest that within Census regions, population growth continues to be strongest in amenity rank 6 counties, while amenity demand was strongest for amenity rank 5 counties. This provides additional evidence that the quality of life deteriorated in the highest amenity counties during the 1990s relative to those in tiers immediately below them, in which amenity rank 4 counties experienced nearly the same increase in demand as counties in the highest tier. The story of relatively weaker productivity growth and increased land supply in top tier counties also is maintained.

4.4 Prognosis for Future Growth in High Amenity Areas

Although an assessment of the current decade can be more accurately made after the next Decennial Census, intercensal estimates of population can be used to examine whether the 1990s trend towards convergence in population growth across the amenity hierarchy appears to be continuing. The results are presented in Table 5, along with those for 1980-1990 for comparison. From column (2) of Table 5, we see continued convergence in growth in the top amenity tiers. Amenity rank 6 counties have the strongest growth, while growth converged among amenity rank 5 and amenity rank 7 counties. To be sure, the coefficient of variation for the population growth coefficients equals: 1.33 for the 1980s, 1.02 for the 1990s (using Table 2 coefficients), and 0.77 for the post-2000 period.

A full appraisal of sources for the pattern of population growth across the amenity hierarchy post-2000 will have to wait until Census of Population and Housing 2010 data on earnings and housing costs are available. However, it is likely high-amenity regions continued to suffer from diminishing quality of life advantages and relatively lower productivity growth, while land supply constraints may have started to become binding (McGranahan, 2008). In addition, with the shocks to housing and other financial asset wealth accompanying the recession which began December of 2007, amenity demand also may have begun to ebb. This points to likely continued narrowing of population growth differentials across the amenity spectrum.

5. Summary and Conclusion

This paper examined the continued strong population growth in high amenity areas during the 1990s and the potential reasons for convergence of population growth across the top tiers of the amenity hierarchy. Based on a decomposition of reduced-form spatial hedonic growth regressions, it was concluded that demand for high amenity areas continued in the 1990s, but the convergence in population growth was related to convergence in quality of life and lower productivity in the top amenity tier counties, not inelasticity in the supply of land and housing. Convergence of quality of life was concluded based on convergence of the change in relative real wages households were willing to forego to live in the respective tiers of high-amenity counties. Lower relative productivity growth could in part be inferred by the lower population growth in top amenity tier counties relative to second tier counties in the face of top tier counties having (slightly) stronger amenity demand and lower growth in housing prices.

Whether growth will continue in high amenity areas then depends on the balance of increased household demand emanating from rising wealth and income against congestion forces such as lower relative productivity growth and deterioration in quality of life. In addition, recent collapses of wealth in the housing and financial markets could be expected to at least in the near term reduce amenity demand. While reduction of wealth and income growth may ease upward pressures on housing prices and alleviate quality-of-life reducing congestion, amenity demand is the overall engine of growth in these areas. To sustain growth, the results suggest policy makers should focus more on protecting and enhancing endogenous quality-of-life characteristics in their area, rather than on increasing housing supply. More research is needed on how to minimize the impact of growth on the natural attributes of high amenity areas. Failure to protect the valued attributes of the local area in an effort to promote growth, however appealing in the present, would ultimately be self-defeating.

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Table 1. Amenity Rank by Census Region

Amenity Rank	Northeast	Midwest	South	West	Total
1	8	0	0	0	8
2	5	290	13	2	310
3	51	380	363	22	816
4	35	88	411	80	614
5	3	1	60	105	169
6	0	0	5	57	62
7	0	0	0	19	19
Total	102	759	852	285	1998

Table 2. Growth Regression Results: 1990-2000 (log points)

	Base Model			Sensitivity Analysis	
	Population (1)	Earnings (2)	Housing (3)	Earnings (4)	Housing (5)
Constant	-0.039 (0.014)*	0.280 (0.028)*	0.422 (0.029)*	0.367 (0.046)*	0.511 (0.029)*
Rank 2	0.057 (0.015)*	-0.025 (0.029)	0.097 (0.029)*	0.005 (0.035)	0.085 (0.028)*
Rank 3	0.070 (0.015)*	-0.089 (0.028)*	-0.009 (0.029)	-0.044 (0.034)	-0.000 (0.028)
Rank 4	0.127 (0.015)*	-0.144 (0.028)*	-0.043 (0.029)	-0.101 (0.035)*	-0.027 (0.029)
Rank 5	0.200 (0.018)*	-0.191 (0.030)*	0.023 (0.032)	-0.144 (0.036)*	0.010 (0.031)
Rank 6	0.255 (0.027)*	-0.187 (0.032)*	0.064 (0.041)	-0.141 (0.038)*	0.036 (0.038)
Rank 7	0.241 (0.047)*	-0.206 (0.044)*	0.007 (0.107)	-0.171 (0.048)*	-0.033 (0.056)
Demog	NA	N	NA	Y[a]	NA
HChar	NA	NA	N	NA	Y[a]
Adj. R^2	0.187	0.106	0.083	0.218	0.152
F-statistic	77.42[a]	39.185[a]	29.91[a]	28.76[a]	23.41[a]

Notes: White heteroscedasticity-consistent standard errors in parentheses below each coefficient; *indicates statistical significance below the 0.01 level based on a two-tailed t-test (there were not any variables only significant below the 0.05 level); [a] indicates their joint statistical significance below the 0.01 level based on an F-test; NA denotes not applicable, Y denotes inclusion of the variables, while N denotes omission of the variables

Table 3. Growth Decomposition (log-point changes)

	Component Growth: 1990-2000					
	Base			Sensitivity Analysis		
	Amenity Demand (1)	Productivity Growth (2)	Land Supply (3)	Amenity Demand (4)	Productivity Growth (5)	Land Supply (6)
Rank 2	0.047	-0.012	-0.259	0.014	0.010	-0.198
Rank 3	0.087	-0.055	0.007	0.044	-0.023	0.019
Rank 4	0.133	-0.088	0.111	0.094	-0.057	0.102
Rank 5	0.197	-0.114	-0.059	0.146	-0.080	0.018
Rank 6	0.202	-0.106	-0.124	0.149	-0.072	-0.004
Rank 7	0.207	-0.120	0.015	0.163	-0.095	0.161

Table 4. Sensitivity Analysis: Growth Decomposition (log-point changes)

	Deflator	Remoteness			Census Region		
	Amenity Demand (1)	Amenity Demand (2)	Prod. Growth (3)	Land Supply (4)	Amenity Demand (5)	Prod. Growth (6)	Land Supply (7)
Rank 2	0.056	0.067	-0.019	-0.251	0.052	-0.007	-0.287
Rank 3	0.086	0.105	-0.068	0.021	0.060	-0.018	-0.225
Rank 4	0.130	0.142	-0.096	0.120	0.081	-0.028	-0.204
Rank 5	0.199	0.220	-0.128	-0.043	0.107	-0.039	-0.147
Rank 6	0.208	0.231	-0.121	-0.107	0.094	-0.026	-0.042
Rank 7	0.208	0.222	-0.130	0.025	0.088	-0.040	0.143

Table 5. Population Growth by Amenity Tier: 1980-1990 and 2000-2008 (log points)

	1980-1990 Base Model (1)	2000-2008 Base Model (2)
Constant	-0.001 (0.040)	-0.062 (0.026)**
Rank 2	-0.028 (0.041)	0.025 (0.026)
Rank 3	-0.007 (0.040)	0.041 (0.026)
Rank 4	0.049 (0.041)	0.075 (0.026)*
Rank 5	0.071 (0.041)***	0.103 (0.026)*
Rank 6	0.103 (0.043)**	0.140 (0.028)*
Rank 7	0.192 (0.049)*	0.107 (0.031)*
Adj. R^2	0.081	0.095
F-statistic	33.07[a]	39.88[a]

Notes: White heteroscedasticity-consistent standard errors in parentheses below each coefficient; *indicates statistical significance below 0.01 level based on a two-tailed t-test, while ** correspondingly indicates significance below the 0.05 level, and *** indicates significance below the 0.10 level; [a] indicates joint statistical significance below the 0.01 level based on an F-test