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U.S. Micropolitan Area Growth: A Spatial Equilibrium Growth Analysis

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Abstract: Because U.S. micropolitan areas have only relatively recently been awarded official status, little is known about their comparative economic performance. Yet, since their inception economic performance among micropolitan areas has received considerable attention from the public and local area policymakers. This paper examines micropolitan area growth during the 1990s, a period of strong national growth. A spatial equilibrium growth framework and estimated reduced-form regressions containing an extensive number of variables are used to assess the sources of differentials in micropolitan area growth. Overall, differences in productivity growth appeared to primarily underlie micropolitan area growth differentials, though household amenities and the elasticity of housing supply also appeared to be nearly as important.

Keywords: micropolitan, regional growth, spatial equilibrium

JEL Codes: R11, R23, R31

1. INTRODUCTION

Recognizing that many counties did not fit neatly into the categories of rural or metropolitan areas, G. Scott Thomas (1989) developed the concept of micropolitan areas. In the year 2000 the U.S. Census Bureau officially designated them for statistical reporting purposes (see U.S. Office of Management and Budget, 2003). In general terms, micropolitan counties are counties that have a principal city with a population between 10,000 and 50,000 or that have tight commuting links to such a city. When first defined based on the 2000 Census, there were 674 micropolitan counties, comprising approximately ten percent of the U.S. population. Micropolitan areas were located mostly in the Midwest and South, with Texas, Ohio, North Carolina, Indiana and Georgia leading the way, and Massachusetts, Rhode Island, and New Jersey containing no micropolitan areas (Frey et al., 2004).

The media, local governments, and policymakers quickly began using the micropolitan area designation (Lang and Danielson, 2008). In addition to the public releases of growth rankings among micropolitan areas by the Census Bureau, an independent economic research firm, POLICOM Corporation, has released annual rankings of economic strength for micropolitan areas since their inception, while *Site Selection Magazine* also ranks micropolitan areas based on economic performance. [1] The micropolitan area rankings are routinely reported in

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[1] The rankings for POLICOM can be found at http://www.policom.com/microrank.htm, while those of Site Selection Magazine for 2011 can be found at http://www.siteselection.com/issues/2012/mar/top-micropolitans-of-2011.cfm, both last accessed September 14, 2012.

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local news outlets and by local chambers of commerce (e.g., Moore, 2012; Owens, 2012; Schramm, 2012; Street, 2012). Growth and competitiveness in a micropolitan area naturally then become benchmarked against other micropolitan areas across the region and nation. Yet, as a relatively recently created construct, micropolitan areas have been studied much less extensively by academics than have either metropolitan areas or nonmetropolitan areas more broadly.

Academic interest in micropolitan areas began prior to their official designation. Interest in micropolitan areas partly stems from their intermediate status between rural and metropolitan areas. Micropolitan areas provide places to escape problems of larger cities and their suburbs, while oftentimes providing urban amenities or access to them (Vias et al., 2002). Interest also arises from micropolitan areas often growing to become metropolitan areas, sometimes forming most of national metropolitan area growth (Elliot and Perry, 1996).[2]

Reflecting their intermediate status, while population grew 14 percent in metropolitan areas during the 1990s, and 7.8 percent in (noncore) rural areas, micropolitan area population grew 10 percent during the period (MacKun, 2005). Vias et al. (2002) similarly report intermediate growth outcomes for the 1970s and 1980s in nonmetropolitan central cities with population of fifteen thousand or greater (an unofficial definition of micropolitan areas prior to their official designation by the Census Bureau).[3] A number of population growth patterns have been observed among micropolitan areas.

During the 1990s, the larger the micropolitan area the faster was its growth (MacKun, 2005). The fastest growing areas also generally were located near metropolitan areas (Plane, 2003; Frey, 2004). Population increased much faster in micropolitan areas located in the west and south, in which the center of gravity for the micropolitan population steadily drifted from the northeast to the southwest, suggesting amenity-based migration and growth (Mulligan and Vias, 2006). This result follows the general pattern found for metropolitan and nonmetropolitan counties more broadly (Deller, 2001; Partridge et al., 2012). Plane et al. (2005) found that there was substantial migration in the latter parts of the 1990s by people in the 50-64 age group from large metropolitan areas to micropolitan and rural areas, which may have been motivated by quality-of-life considerations.

Therefore, the purpose of this study is to analyze U.S. micropolitan area population growth to better understand variations in growth among micropolitan areas. We examine the 1990s, the decade immediately preceding the definition of micropolitan areas, a period of robust growth, and the most recent period for which all required data were available at the time of the study. Besides the data issue, the most recent decade not only contained two recessions, including the most severe contraction since the Great Depression, it also contained a housing bubble that affected growth dynamics (Mian and Sufi, 2009). Gabe and Florida (2011) conclude that the housing bubble created "false" economies in regions of the country post-2002. So, the 1990s more likely reflected the long-run determinants of growth in micropolitan areas.[4]

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[2] Five areas designated as micropolitan based on the 2000 Census of Population achieved metropolitan area status in 2010: Cape Girardeau-Jackson, MO-IL, Manhattan, KS, Mankato-North Mankato, MN, Palm Coast, FL and Lake Havasu City-Kingman, AZ

[3] Using the official definition of micropolitan areas used in this study, population growth in micropolitan areas during the 1980s was 2.9 percent, which was in between the growth of population in metropolitan areas of 11.8 percent and the 1.1 percent decline of population in rural areas.

[4] Partridge et al. (2012) report that some of the long-run growth patterns in metropolitan and nonmetropolitan counties in the last half of the twentieth century weakened somewhat during the 2000-2007 period, and there was a dramatic downward shift in the migration response to regionally asymmetric demand shocks

To disentangle the sources of micropolitan area growth we use the spatial equilibrium growth framework of Glaeser and Tobio (2008). The empirical analysis consists of estimating reduced-form equations for population growth, wage growth and housing cost growth. An extensive number of variables, which have been found to be important growth determinants for micropolitan areas, and regions generally, are included in each regression. The structural equations of the Glaeser and Tobio (GT) model are then used to disentangle the estimated reduced-form coefficients and identify the relative contributions of three broad sources of growth: 1) household amenities; 2) firm productivity attributes; and 3) housing supply. The most important variable groups and individual variables also are identified. Finally, we examine the residuals of the estimated reduced form equations to determine whether the unaccounted for portions of population growth derive more from household, firm, or housing supply considerations.

Among the primary findings, based on general dominance variance analysis, we find industry composition to be the most important source of variation in micropolitan area population growth. The group of Census Division dummy variables is found to be the second most important influence on population growth. Based on the patterns of Census Division coefficients in the three regressions, differences in productivity growth primarily underlie the Census Division differences, particularly for the Mountain and Pacific states, which also were inferred to have the most restrictive housing supply constraints or policies. The coefficients also were consistent with differentials in Census Division household amenity attractiveness, but to a lesser extent. The single most important population growth variable though in terms of per standard deviation impact was the average January temperature. The third most influential group of variables on population growth was state and local policy variables, in which county spending on education and highways spurred growth, while a negative effect was found for state income taxes. Other variables having large individual impacts included the distance of a micropolitan area from the nearest metropolitan area and the incremental distance to a metropolitan area greater than 250,000 in population, suggesting that remoteness reduced growth.

2. BRIEF REVIEW OF THE GLAESER-TOBIO GROWTH MODEL

We use the spatial growth model that Glaeser and Tobio (2008), henceforth GT, used to examine the sources of growth in the U.S. South. Rickman and Rickman (2011), henceforth RR, used the model to examine the potential changing role of natural amenities in U.S. nonmetropolitan county growth. The reader is referred to both of these studies for detailed presentations of the model equations. Below, we discuss the framework and its application in this study.

GT extend the spatial equilibrium framework of Haurin (1980) and Roback (1982). The primary extensions are the translation of spatial equilibrium into a growth context and incorporation of a housing supply shifter that represents differences in the elasticity of housing supply. Hence, in addition to reflecting household amenity attractiveness as in the spatial equilibrium framework, housing prices also reflect the effects of housing supply constraints, including those related to policies. In fact, GT attribute the strong population growth in the South to more favorable housing supply conditions rather than to household amenity attractiveness.

A growth dimension is incorporated in the spatial equilibrium model by adding unanticipated shocks to (innovations in) productivity, amenity attractiveness, and housing

supply. The shocks/innovations arise either from changes in locational characteristics or of their importance. In the absence of such changes a spatially balanced growth path results (Partridge et al., 2008a).

GT and RR demonstrate the derivation of estimable reduced-form growth equations for growth in area population, wages and housing costs. Rather than simply examine the coefficients related to Sunbelt status of U.S. metropolitan areas as GT did or those related to the natural amenity ranking of a U.S. nonmetropolitan county as did RR, we examine the coefficients for all independent variables. The estimated reduced-form coefficients can then be used to derive the shocks/innovations in household amenities, productivity and housing supply.

Using these expressions and estimated reduced-form coefficients, GT solve for the vectors of shocks/innovations ($\boldsymbol{\lambda}$) in household amenities ($\boldsymbol{\phi}$), productivity (A) and housing supply (L):

$$\boldsymbol{\lambda}_A = (1-\beta-\gamma)\mathbf{b}_N + (1-\gamma)\mathbf{b}_W \quad (1)$$

$$\boldsymbol{\lambda}_\phi = \alpha\mathbf{b}_{Ph} - \mathbf{b}_W \quad (2)$$

$$\boldsymbol{\lambda}_L = \mathbf{b}_N + \mathbf{b}_W - [\delta\mathbf{b}_{Ph}/(\delta-1)] \quad (3)$$

where $\mathbf{b}_N$, $\mathbf{b}_W$, and $\mathbf{b}_{Ph}$ are estimated reduced-form coefficients from the population, wage, and housing-cost equations; β and γ are Cobb-Douglas input shares for labor and capital; α is the share of household income spent on housing; δ relates to the cost of housing per unit of land, where a larger value indicates increased cost.

Equation (1) shows that strong productivity growth is evidenced by greater wage and population growth, weighted by the production input share parameters. The negative of the real wage effect of the variable reveals the household amenity effect [Equation (2)]. More favorable housing supply conditions are revealed by strong population and wage growth relative to housing price increases. Estimates of these shocks can then be used with calculated multiplier effects from the model to obtain the relative importance of each shock to population growth in the area.

Because we also are interested in whether the estimated reduced-form residuals (μ) reveal anything about the sources of unexplained population growth ($\boldsymbol{\lambda}\mathbf{U}$) we still use the expressions for the coefficients in Equations (1)-(3) but instead substitute the residuals in place of the estimated reduced-form coefficients so that

$$\boldsymbol{\lambda}\mathbf{U}_A = (1-\beta-\gamma)\boldsymbol{\mu}_N + (1-\gamma)\boldsymbol{\mu}_W \quad (4)$$

$$\boldsymbol{\lambda}\mathbf{U}_\phi = \alpha\boldsymbol{\mu}_{Ph} - \boldsymbol{\mu}_W \quad \mathbf{(5)}$$

$$\boldsymbol{\lambda}\mathbf{U}_L = \boldsymbol{\mu}_N + \boldsymbol{\mu}_W - [\delta\boldsymbol{\mu}_{Ph}/(\delta-1)] \quad (6)$$

where the expressions reveal whether the sources of unexplained growth relate more to omitted productivity, household amenity, or housing supply considerations.

3. EMPIRICAL MODEL

Following from the above, three hedonic cross-sectional growth regressions are estimated for the 1990 to 2000 period. With the exceptions of lagged levels of the dependent variables, each equation contains the same independent variables. To avoid direct endogeneity, most variables are measured at or near the beginning of the period.

To capture broad region fixed effects (Glavac et al., 1998; Mulligan and Vias, 2006; Glaeser and Tobio, 2008), we include variables for the nine Census divisions minus one (**CENSUS**). Although the Census Division dummy variables likely capture the amenity portion of the shift in micropolitan area growth from the northeast to the southwest (Mulligan and Vias, 2006), we also include variables measuring natural amenities related to climate, topographic variation and water coverage to capture the influence of within-Census Division variation in natural amenity attractiveness (**AMEN**).[5] These variables consistently have been found to be associated with growth generally in the United States (McGranahan, 1999; Deller et al., 2001; Rickman and Rickman, 2011; Partridge et al., 2012). Several variables reflecting the position in the urban hierarchy (**GEOG**) are included as they have been shown to be associated with nonmetropolitan and metropolitan growth during the 1990s (Partridge et al., 2008a; 2008b) and micropolitan areas have been reported to grow slower the more remote they are (Plane, 2003; Frey, 2004).

To control for state and local policy effects on growth, which have been found to significantly influence (unofficial) central micropolitan counties (Glavac et al., 1998) and nonmetropolitan area wage and housing rent growth (Yu and Rickman, forthcoming), a vector of variables related to state and county taxes and expenditures are included, along with a variable denoting whether a micropolitan area was located in a state possessing a right-to-work law (**POLICY**). Given their importance in explaining growth generally (Glaeser et al., 1995), we include variables reflecting educational attainment and opportunities (**EDUC**). Demographic variables (**DEMOG**) related to ethnicity, family structure, and age also are included. Finally, following the literature on micropolitan area growth (Elliot and Perry, 1996, Vias et al., 2002), and regional growth generally (e.g., Sutton and Day, 2004), we control for the influence of industry structure (**IND**).

Therefore, the three reduced-form equations can be written as:

(7) $POPGRW_i = f(DEN_i, AMEN_i, CENSUS_i, GEOG_i, POLICY_i, EDUC_i, DEMOG_i, IND_i)$

(8) $WGRW_i = g(WLAG_i, AMEN_i, CENSUS_i, GEOG_i, POLICY_i, EDUC_i, DEMOG_i, IND_i)$

(9) $RGRW_i = h(RLAG_i, AMEN_i, CENSUS_i, GEOG_i, POLICY_i, EDUC_i, DEMOG_i, IND_i)$

where **POPGRW**, **WGRW** and **RGRW** denote the rate of population, wage, and housing cost growth from 1990 to 2000, respectively; **DEN** denotes population density in 1990; **WLAG** is the 1990 wage rate level; **RLAG** is the 1990 level of housing costs/rent; and *i* denotes micropolitan area.

4. EMPIRICAL IMPLEMENTATION

Micropolitan areas, as defined by the U.S. Office of Management and Budget (2003), located in the 48 contiguous continental states are used in the analysis. Thus, the analysis begins with 554 micropolitan areas that encompass 662 counties in the lower 48 states. Data at the county level are aggregated (population-weighted) into the micropolitan-area definitions. Variable descriptions, sources and descriptive statistics appear in the Appendix.

[5] The Census division dummy variables also may capture other effects such as the effect of county size on economic outcomes, where counties in many western states are much larger than those in the east.

4.1 Variables and Data

Following Partridge et al. (2010), Rickman and Rickman (2011), and Yu and Rickman (forthcoming), median gross rent used to construct **RGRW** and **RLAG** is from the Census of Population for 1990 and 2000. Median rent is constructed as a weighted average of the median gross monthly rent for rental housing and imputed rent for owner occupied housing, with the shares of renter and owner occupied houses used as the weights. The median gross rent for rental housing is defined as contract rent plus the estimated average monthly cost of utilities. The median imputed rent for owner occupied housing is calculated by converting the median value of owner occupied housing (complete count) using a discount rate of 7.85 percent (Peiser and Smith, 1985). The median gross rent does not control for differences in housing quality between regions, though this has not been found to affect estimates of county growth determinants (Rickman and Rickman, 2011), and can introduce endogeneity. Population likewise, is from the Census of Population for 1990 and 2000. Wage rates used to calculate, **WGRW** and **WLAG**, are obtained by dividing Census nominal private nonfarm payroll by private nonfarm employment.

CENSUS includes dummy variables for Census divisions. Divisions 1-9 are New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Rocky Mountain, and Pacific, respectively: We omit New England to avoid perfect collinearly. **AMEN** includes USDA Economic Research Service's measures of natural amenities: average January and July temperatures, average July humidity, water area and topographic variation (typography). **DEMOG** includes births per 1000 population, percent of married households, population percentages of African, Hispanic and Asian Americans; and the percent of people in the 25-49, 50-64 and 65 plus age groups, all from the Census of Population 1990. **EDUC** includes percent of the adult population aged 25 years and older with a high school degree, the percent with a four year college degree or higher, and the presence of a land-grant university.

POLICY includes numerous regional tax and expenditure variables expressed as a share of personal income for the county or state: county and state property and sales taxes, county and state government spending on highway and safety, county spending on education, state spending on health and hospitals, state personal and corporation income taxes, and whether the micropolitan area's state has a right-to-work law, all from Yu and Rickman (forthcoming).[6] **IND** includes: percent jobs in agricultural services, farming, mining, construction, manufacturing, services, and government. It also includes the unemployment rate to control for differing beginning period levels of slackness in the labor market.

GEOG includes the distance of the micropolitan area to the nearest metropolitan area (MA), measured between the population-weighted centroids of the areas. It also includes the incremental distances to more populous higher tiered urban centers to capture the incremental or marginal costs on growth to reach each higher-tiered (larger) urban center: the incremental (additional) distances to reach MAs of at least 250,000, 500,000, and 1.5 million people. The largest category generally corresponds to national and top-tier regional centers, with the 500,000-

[6] The omitted fiscal variables include intergovernmental revenues, non-general revenues, non-general expenditures (i.e., liquor store, utility, or insurance trust expenditures), and welfare expenditures. Thus, the coefficient for each fiscal variable should be interpreted as the effect of increasing that expenditure or tax while offsetting it by the average of the omitted categories (Yu and Rickman, forthcoming). To consider the impact of changing more than one category, the coefficients should be added together; e.g., increasing local property taxes to increase local education spending.

1.5 million population category reflecting subregional tiers (Partridge et al., 2008a; 2008b; 2010).[7]

4.2 Econometric Issues

Each regression is estimated using OLS and White's correction to the variance-covariance matrix for heteroskedasticity. Because the counties are aggregated into micropolitan areas, which are distributed widely with rural and metropolitan counties in between, spatial autocorrelation is not considered. The influence of metropolitan areas on micropolitan areas is accounted for by the distance variables in the **GEOG** vector.[8]

Analysis of the raw data revealed significant variation in the data for the independent variables and the existence of potential outliers that might have undue influence on the estimated regression results. Because we mostly are interested in addressing the growth determinants for more typical micropolitan areas, we purged the areas from our sample with disproportionate values of the independent variables using the method of the Hat Matrix. The Hat Matrix is defined as $\mathbf{H} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'$, where the disproportionate $\mathbf{X}$ variables are purged based on leverage analysis of the diagonal of the matrix (Belsley, Kuh, and Welsch, 1980).

We also used the method of k-means clustering to identify outliers of micropolitan growth in the dependent variables. The k-means clustering method groups the data points into a set into k clusters, minimizing the Euclidean distance between the average in the cluster (cluster center) and each point in the cluster.[9] Most of the outliers identified by this procedure corresponded to micropolitan areas that were identified as outliers by the Hat Matrix method.

We began the analysis with 554 micropolitan areas. The Hat Matrix method resulted in the purging of 40 observations, with three additional areas purged due to extreme outliers identified by cluster analysis. This left 511 micropolitan areas for the regression analysis. The purging of outliers resulted in a reduction of total variance of 25.2 percent in population growth, 9.1 percent in housing cost growth, and 20.3 percent in wage growth. Nevertheless, the data still show significant variation in the dependent variables: population growth ranges from negative 17.1 percent to positive 73.6 percent during the period; -2.8 percent to 133.7 percent for housing costs; and -2.9 percent to 97.9 percent for wages (Appendix).

5. RESULTS

Table 1 contains the regression results for the reduced-form equations. All three regressions are statistically significant. The population growth regression has an R^2 of .56, in

[7] For example, if a micropolitan county is 50 kilometers from the nearest metropolitan area, which has less than 250,000 people, and 100 kilometers from the nearest metropolitan area with more than 250,000 people, the incremental distance to the nearest MA over 250,000 is 50 kilometers. Using actual distances rather than incremental distances has been found not to affect growth regression results, only resulting in somewhat greater multicollinearity (Partridge et al., 2008a; 2008b).

8 Consistent with the literature (Partridge et al., 2010, 2012; Rickman and Rickman, 2011; LeSage and Dominguez, 2012), we do not include metropolitan or rural counties in the sample to account for spatial spillovers because by definition metropolitan and rural areas are separate functional economic regions with likely differing growth dynamics from micropolitan areas. Also, even if slope shifters are specified for rural and metropolitan counties to allow for differing dynamics in a common sample, any spillovers between these counties and micropolitan areas likely differ from each other; i.e., homogenous spillover effects would be assumed in spatial econometric estimation despite assuming differing growth dynamics with the use of slope shifters (Yu and Rickman, forthcoming).

9 The FASTCLUS procedure in SAS was used to perform a five centroid cluster analysis in identifying extreme above and below growth in the dependent variables for each dependent variable.
http://support.sas.com/documentation/cdl/en/statugcluster/61777/PDF/default/statugcluster.pdf

which 23 variables are significant at the 5 percent level and an additional three at the 10 percent level. The housing cost growth regression has an R^2 of .72, with 29 of the variables significant at the 5 percent level and an additional 3 significant at the 10 percent level. Fully 19 of the significant variables in the housing cost regression also are significant in the population growth regression, with all but one having the same sign in both regressions. The wage growth regression has an R^2 of .39, in which twelve variables are significant at the 5 percent level and an additional five variables are significant at the 10 percent level. Six of the significant variables also are significant in the population and the housing cost regressions.[10]

It generally could be expected that variables positively influencing housing costs also positively influence population growth. Greater amenity attractiveness of an area attracts more households and increases housing costs. Yet, while more firms increase nominal wages, more households may not affect the nominal wage rate, and may even have a depressive effect. Thus, wage rates and population growth less likely move in tandem, depending on whether the firm or household effect is greater in the area (Partridge and Rickman, 1999; Partridge et al., 2010).

5.1 Interpretation of the Estimates

The natural amenity variables generally have their expected effects. Increased natural amenity attractiveness significantly increases population growth (four of the five variables), significantly increases growth in housing costs (two of the five variables) and significantly reduces wage rate growth (two of the five variables). The variables raising housing costs and reducing (or not affecting) nominal wages fit the pattern of greater household amenity attractiveness as revealed by Equation (2). Among the three regressions, only water coverage has an unexpected sign in the wage regression if water coverage is viewed solely as a household amenity. Yet, because boundaries of counties along the ocean coasts and the Great Lakes extend three miles out into the water (McGranahan, 1999), and coastal areas have been found to be productive (Rappaport and Sachs, 2003), the water coverage variable also may be capturing productivity effects, which work to increase wages.[11]

Consistent with remoteness reducing micropolitan area growth (Plane, 2003; Frey, 2004), greater distance from any metropolitan area, and the incremental distance from a metropolitan area with a population greater than 250,000, significantly reduced population growth. These two variables, along with the incremental distance to a metropolitan area with more than 500,000 people reduced housing cost growth. Except for the distance to the nearest metropolitan area, all distance variables significantly reduced wage growth.

[10] The results do not change appreciably when re-estimated after adding back in the outlier micropolitan areas. R^2 rises slightly for population growth (.57), while slightly decreasing for wage growth (.36) and housing costs (.71). The number of significant variables rises by three in the population regression, falls by three in the wage equation and falls by four in the housing cost regression. The most notable change was that the share of employment in agricultural services becomes insignificant in all three regressions. The employment share in the farming sector becomes insignificant in the population regression. The manufacturing and government employment shares become insignificant in the housing cost regression. The coefficient for the water coverage variable in the wage regression becomes insignificant, though remaining positive. The incremental distance to the top-tier metropolitan areas becomes insignificant in the wage equation.

[11] A dummy variable representing location on an ocean coast was insignificant when added to all three regressions, with *t*-statistics of 0.39, 0.13, and -1.06 in the population, wage and housing cost regressions, respectively. This is not unexpected as coastal waters factor into the water coverage variable (McGranahan, 1999). The coefficients on the water coverage variable decreased slightly, remaining positive and significant in the wage and housing cost regressions.

Table 1. Reduced-form Regressions (robust *t*-statistics in parentheses)

Variable	Population		Housing Rents		Wages	
TempJan	0.57	(5.07)[a]	0.13	(0.83)	-0.47	(-3.64)[a]
TempJuly	-0.65	(-3.29)[a]	-1.21	(-4.47)[a]	0.43	(1.89)[c]
Humidity	-0.21	(-2.57)[b]	-0.15	(-1.35)	0.08	(0.83)
Water	0.07	(1.33)	0.33	(5.02)[a]	0.13	(2.21)[b]
Typography	0.17	(1.93)[c]	0.16	(1.34)	-0.02	(-0.23)
Dist to next Metro	-0.03	(-2.5)[b]	-0.08	(-5.62)[a]	-0.02	(-1.37)
IncDist250k	-0.02	(-2.67)[a]	-0.06	(-6.87)[a]	-0.02	(-2.42)[b]
IncDist500k	0.00	(-0.44)	-0.04	(-3.45)[a]	-0.02	(-1.76)[c]
IncDist1500k	0.00	(-0.26)	0.00	(-0.6)	-0.01	(-2.11)[b]
D2	5.04	(1.33)	23.75	(4.2)[a]	-0.55	(-0.13)
D3	9.93	(2.83)[a]	51.50	(9.56)[a]	4.75	(1.17)
D4	10.58	(2.76)[a]	42.94	(7.49)[a]	2.34	(0.53)
D5	18.06	(4.57)[a]	40.97	(7.01)[a]	1.03	(0.22)
D6	10.92	(2.65)[a]	38.67	(6.36)[a]	3.79	(0.79)
D7	7.96	(1.85)[c]	32.39	(5.14)[a]	5.52	(1.11)
D8	14.79	(2.78)[a]	62.28	(8.18)[a]	16.25	(2.64)[a]
D9	1.95	(0.34)	67.32	(8.47)[a]	13.44	(2.05)[b]
PopDens90	0.00	(-0.07)	NA		0.01	(0.60)
MedGR90	NA		-0.09	(-7.22)[a]	NA	
AvgWage90	NA		NA		-2.87	(-11.00)[a]
LandGrantU	0.54	(0.24)	-0.05	(-0.02)	-0.23	(-0.09)
%FarmJobs90	0.31	(1.83)[c]	0.30	(1.31)	0.17	(0.84)
%AgServJobs90	-1.27	(-2.87)[a]	-1.15	(-1.89)[c]	-1.03	(-2)[b]
%MinJobs90	-0.96	(-5.97)[a]	-1.17	(-5.22)[a]	-0.07	(-0.36)
%ConstJobs90	0.40	(1.54)	0.27	(0.77)	0.85	(2.84)[a]
%MfgJobs90	-0.20	(-2.5)[b]	-0.19	(-1.73)[c]	0.18	(1.94)[c]
%ServsJobs90	0.12	(1.14)	0.08	(0.57)	0.10	(0.82)
%GovJobs90	-0.13	(-1.37)	-0.30	(-2.24)[b]	-0.14	(-1.22)
%Bachelors90	0.88	(4.43)[a]	1.10	(3.81)[a]	0.48	(2.06)[b]
%High School90	-0.03	(-0.26)	-0.13	(-0.84)	-0.11	(-0.82)
%Unempl90	-0.29	(-1.02)	-0.89	(-2.26)[b]	-0.69	(-2.1)[b]
BirthRate90	0.72	(2.91)[a]	-0.87	(-2.56)[b]	-0.03	(-0.12)
%PopBlack90	0.01	(0.2)	0.15	(1.56)	0.17	(2.27)[b]
%PopHisp90	-0.14	(-2.39)[b]	-0.17	(-2.16)[b]	0.03	(0.51)
%PopAsian90	-0.41	(-0.37)	-3.59	(-2.39)[b]	1.30	(1.01)
%Age2549	0.25	(0.94)	0.50	(1.37)	0.58	(1.89)[c]
%Age5064	1.20	(2.38)[b]	1.81	(2.63)[a]	0.78	(1.34)
%Age65plus	-0.24	(-0.79)	-1.21	(-3.00)[a]	-0.29	(-0.84)
PCMrdHH90	0.73	(4.47)[a]	0.56	(2.37)[b]	0.23	(1.19)
Cty92property	-48.96	(-0.92)	-84.39	(-1.15)	-23.55	(-0.38)
Cty92sales	196.10	(1.47)	394.74	(2.16)[b]	-69.01	(-0.45)
Cty92highway	558.96	(3.71)[a]	455.18	(2.24)[b]	33.81	(0.19)
Cty92safety	-520.99	(-2.29)[b]	-157.89	(-0.51)	36.96	(0.14)
Cty92education	92.61	(2.05)[b]	135.95	(2.22)[b]	76.34	(1.46)
Cty92property	1.09	(0.01)	-26.56	(-0.2)	60.63	(0.54)
St92sales	-46.01	(-0.53)	-204.72	(-1.74)[c]	7.70	(0.08)
St92inctax	-218.53	(-3.26)[a]	-134.73	(-1.48)	-28.92	(-0.37)
St92corptax	-9.14	(-0.03)	-175.15	(-0.43)	169.92	(0.5)
St92hospitals	-604.83	(-1.97)[b]	-89.08	(-0.21)	47.75	(0.13)
St92highway	-93.30	(-0.65)	95.78	(0.49)	-289.3	(-1.74)[c]
St92safety	438.04	(1.35)	-1,337.89	(-2.92)[a]	-109.44	(-0.29)
Right to Work	0.06	(0.04)	4.95	(2.29)[b]	2.54	(1.37)
R^2	0.558		0.718		0.392	
F-statistic	11.6 (<.0001)		23.39 (<.0001)		5.81 (<.0001)	

NA denotes not applicable [a]denotes significant at or below the 0.01 level [b]denotes significant at or below the 0.05 level [c]denotes significant at or below the 0.10 level

Thus, the weaker growth in population and wages according to Equation (1) reveals increasing productivity disadvantages the more remote the micropolitan area is in the urban hierarchy, consistent with the findings of Partridge et al. (2010) for remoteness of all areas generally during the 1990s. The slower growth in housing costs is sufficient to cause Equation (3) to indicate that remoteness from metropolitan areas (except from the largest areas) also was associated with more favorable housing supply environments, particularly for greater distance from any metropolitan area (calculations not shown), a result not previously reported in the literture.[12]

Industry composition significantly influenced population growth. Larger initial shares of payroll employment in agricultural services, mining and manufacturing were associated with slower population growth over the decade. A larger initial share of farm employment was associated with faster population growth. The stronger growth associated with farming and slower growth in manufacturing and mining are consistent with the patterns reported in Vias et al. (2002). A similar pattern among sectors is apparent for housing cost growth. Wage growth was stronger for initial shares of construction and manufacturing.

It could be expected that the primary influence of industry composition would occur through growth-promoting firm productivity effects (Partridge and Rickman, 1999; 2003a). But the negative population-growth effect of manufacturing suggests that it did not experience productivity led expansion. But productivity growth only translates into employment (and population) growth if the demand for goods and services and labor supply are sufficiently elastic (Combes et al., 2004). Also, wages can increase in manufacturing even when employment declines if the most productive workers are retained or technological innovation is spurred in the face of negative demand shocks (adjustments not allowed in the GT model) such as those arising from increased exposure to international trade (Autor et al., 2011). When also considering the significantly negative effect on housing costs, greater employment concentration in manufacturing also may be a household disamenity, possibly associated with greater area pollution. The negative effect on population growth and housing costs, along with the insignificant wage effects suggests that greater employment concentration in mining also may reduce household amenity attractiveness of the area. Combined with the significant wage effect, the nearly significant positive effect on population for the construction employment share suggests a productivity role for the variable.

Among the education variables, only the percent of the population with a four-year college degree or higher was associated with faster growth, being statistically significant in each equation. From Equation (1), this suggests the variable as strongly reflecting increasing productivity advantages. Having a land grant university was insignificant, suggesting that besides potentially supplying human capital in the area, it did not spur micropolitan area growth. This is consistent with the results of Partridge et al. (2011) that the most important role of universities in spurring growth is as a source of supply for human capital, not as a source of localized knowledge spillovers.

Regarding the county fiscal variables, county spending on highways and education were significantly associated with stronger population and housing cost growth. The positive effects on population growth, absence of a wage effect and positive effects on housing costs suggests

[12] The following coefficient values from Rickman and Rickman (2011) are used in the equation calculations: the housing expenditure share, α=0.23; the mobile capital share in production, γ=0.3; the labor share in production, β=0.6; while δ=1.5.

that county spending on highways and education increased household amenity attractiveness of the area (Equation 2), while it also increased productivity (Equation 1), consistent with the results of Yu and Rickman (forthcoming) for all nonmetropolitan areas. County spending on safety had a negative effect on population growth, while county sales taxes had a surprising positive effect on housing cost growth. No significant county fiscal effects were found for wages.

State income taxes and spending on hospitals negatively affected population growth. Significantly negative effects on housing cost growth also were found for state sales taxes and state spending on public safety. Combined with the absence of wage effects, the negative housing cost effects suggest state income taxes and spending on public safety adversely affected the amenity attractiveness of the area. Having a state right-to-work law only (positively) affected housing costs. A significant negative effect on wage growth occurred for state spending on highways; when combined with the insignificant effect on housing costs, this suggests a positive household amenity effect according to Equation (2), consistent with the evidence for nonmetropolitan counties generally reported by Yu and Rickman (forthcoming).

The Census Division dummy variables mostly are individually significant in the population and housing cost growth equations. The coefficients reveal the noted shift of micropolitan population growth from the northeast to the southwest; all divisions grew faster than the New England division (the omitted category), while fastest growth occurred in the Rocky Mountain division, which includes the southwestern states of Arizona, Nevada and New Mexico. Only the variables for Census Divisions 8 and 9 are significant in the wage equation.

Use of Equations (1)-(3) and the statistically significant coefficients from the three regressions reveals the sources of the differences. The λ's calculated from these equations can then be used with the population growth equations of the GT model (GT, p. 618) to determine which source had the largest effect on population growth. Notable results (calculations not shown) include the strongest productivity growth in Census Divisions 8 and 9–the Mountain and Pacific states, combined with the most restrictive housing supply constraints or policies.

All Census Divisions have more restrictive housing supply constraints or policies than the omitted category, the New England states. The coefficients for the Census Division dummy variables are sufficiently large in the housing cost equation to produce negative values in Equation (3) for all census divisions relative to the New England states (calculations not shown). The (perhaps surprising) result for the New England and Mid Atlantic divisions may be attributable to the limited number of micropolitan areas in the divisions, where Massachusetts, New Jersey and Rhode Island did not contain any micropolitan areas (Frey et al., 2004).

Evidence for the finding of restrictive housing supply policies in the Pacific is consistent with the conclusion of Mian and Sufi (2009) for metropolitan areas and with Gyourko et al. (2008) for all area types. Based on a survey of over two thousand jurisdictions concerning various local area land use and housing regulations, Gyourko et al. (2008) construct an index of the restrictiveness of residential housing regulations. The index mostly reflects local characteristics, such as local zoning practices and limits on the number of building permits issued, but also reflects statewide influences. Among all states, Washington, California, and Oregon have the 7^{th}, 9^{th}, and 18^{th} most restrictive policies, when averaged across all areas within each state.

Notable micropolitan examples of Pacific states based on our calculations include: Walla Walla, Washington, with 13.9 percent population growth and 87.4 percent growth in housing costs; Bishop, California, with -1.8 percent population growth and 35.9 percent growth in housing costs; and La Grande, Oregon with 3.9 percent population growth and 93.4 percent growth in housing costs. An example from the Rocky Mountain division is Sterling, Colorado (the 11th most restrictive state), with 16.7 percent population growth and 90.7 percent growth in housing costs.

Consistent with our Division 7 results, notable examples of less-restrictive residential housing policies include: Beeville, Texas, with 28.7 percent population growth and housing cost growth of 23.0 percent; Granbury, Texas, with 39.5 percent population growth and a 47.2 percent increase in housing costs; and Tahlequah, Oklahoma, with 24.9 percent population growth and a 47.8 percent increase in housing costs. Texas and Oklahoma are ranked by Gyourko et al. (2008) as the 30th and 38th most restrictive states for housing supply; the other state in the division, Louisiana, is ranked 48th. One of the least restrictive micropolitan areas in our sample is Palm Coast, Florida (Division 5), which experienced 73.6 percent population growth and only 27.1 percent growth in housing costs.[13]

The estimates also reflect differences in natural amenities, particularly for the South Atlantic states (Division 5), consistent with studies that have found amenities to primarily be capitalized into land/housing prices rather than wages (Wu and Gopinath, 2008; Rickman and Rickman, 2011). Yet, the standard deviation of the estimated population growth of the three sources reveal productivity growth as the dominance source for the Census Division differences, followed next by natural amenities and then housing supply policies. However, with other natural amenity variables included, the Census Division dummy variables simply may capture unmeasured natural amenity attributes. Perhaps also, the firm productivity growth relates to natural amenities as they have been shown to attract human capital (e.g., creative-class members) by McGranahan and Wojan (2007), and may attract footloose firms with owners who wish to live a high amenity location.

5.2 Variance Analysis

Consistent with the analysis of Ferguson et al. (2007) for Canadian communities, to assess which groups of variables most explain the variation in population, housing cost, and wage growth we perform a general dominance analysis.[14] A predictor is said to generally dominate another predictor when it has a higher average additional contribution to the R^2 among all combinations of predictors (Azen and Budescu, 2003). With seven variable groups there are $(2^7\text{-}1) = 127$ possible different statistical combinations possible for the variable group regressions, which are the base regressions that have to be run for comparison. There are 63 additional regressions that have to be run for each group to find out the additional contributions to the R^2 when the respective variable group is added to the base regressions, or a total 441

[13] As noted in footnote 2, Palm Coast attained metropolitan area status with the 2010 Census of Population.

[14] An alternative approach would be to average the coefficients across all model specifications. Advantages of our variance-decomposition approach are that problems of within-group multicollinearity are less problematic (Ferguson et al., 2007), the computation burden is reduced, and our focus is on the contribution of variable groups to explaining variation in growth, not single variables.

additional contribution regressions. Therefore, a total of 1,704 regressions were run for all three models (population, wage and housing cost) to establish general dominance analysis.[15]

The average contributions to explaining population, housing cost and wage rate growth by the different variable groups are shown in Tables 2-4. The Census Division variables explained over 40 percent of housing cost growth, very little of wage growth and about 20 percent of population growth. Based on the discussion of the signs of the coefficients above, this suggests that Census Division differences in productivity, followed by differences in amenity attractiveness were primary drivers of variation in micropolitan performance during the 1990s.

Aside from the Census Division dummy variables for housing costs, industry composition explained the most variation of all three variables: 16.5 percent of the variation in housing cost growth, 22.2 percent of variation in population growth and 77.4 percent of wage growth. Per the discussion above, given the expected relationship between wages and productivity (Partridge and Rickman, 1999; 2003a), most of the influence of industry composition most likely worked through productivity, though there also could have been (negative) amenity effects through manufacturing and mining.

The next most important variable groups for population growth were the policy and demographic variables. The two groups of variables were important in explaining housing cost growth but not wage growth. Natural amenities were more important in explaining housing cost growth though than the demographic and policy variables. Recall that with Census Division dummy variables included, the measures of natural amenities only reflect the influence of their within division variation. The education and geography variables generally explained the least amount of variance in micropolitan area growth.

TABLE 2. General Dominance Variance Analysis—Population Growth

Combinations	Amenity	Demographics	Education	Policy	Industry	Geography	Census
K=0	0.120	0.100	0.012	0.165	0.139	0.035	0.159
K=1	0.097	0.104	0.040	0.157	0.146	0.030	0.138
K=2	0.074	0.099	0.045	0.096	0.138	0.027	0.116
K=3	0.056	0.091	0.045	0.068	0.122	0.023	0.097
K=4	0.044	0.082	0.041	0.050	0.104	0.018	0.083
K=5	0.035	0.071	0.034	0.040	0.085	0.013	0.073
K=6	0.027	0.057	0.025	0.035	0.064	0.008	0.067
Simple Avg.	0.065	0.086	0.035	0.087	0.114	0.022	0.105
Percent of Explained Variation	12.6%	16.8%	6.7%	17.0%	22.2%	4.3%	20.4%

[15] We used the adjusted R^2 for the general dominance analysis rather than R^2. The adjusted R^2 is preferable for decomposition when there are many variables and different numbers of variables in some groups between the models that are being compared. The sample adjusted R^2 also is a better estimate of the population R^2 (Wooldridge, 2005 p. 2007).

TABLE 3. General Dominance Variance—Rent Growth

Combinations	Amenity	Demographics	Education	Policy	Industry	Geography	Census
K=0	0.104	0.130	0.076	0.153	0.164	0.024	0.405
K=1	0.107	0.100	0.039	0.122	0.151	0.020	0.365
K=2	0.105	0.079	0.021	0.099	0.136	0.027	0.327
K=3	0.095	0.064	0.011	0.077	0.116	0.036	0.285
K=4	0.079	0.050	0.007	0.056	0.096	0.044	0.240
K=5	0.060	0.039	0.007	0.035	0.075	0.049	0.193
K=6	0.040	0.027	0.009	0.017	0.054	0.049	0.146
Simple Avg.	0.085	0.070	0.024	0.080	0.113	0.035	0.280
Percent of Explained Variation	12.3%	10.2%	3.5%	11.6%	16.5%	5.2%	40.8%

TABLE 4. General Dominance Variance Analysis—Wage Growth

Combinations	Amenity	Demographics	Education	Policy	Industry	Geography	Census
K=0	0.019	-0.009	0.013	0.007	0.256	-0.002	0.011
K=1	0.025	-0.003	0.015	0.012	0.262	0.001	0.015
K=2	0.028	0.004	0.015	0.014	0.263	0.005	0.018
K=3	0.030	0.009	0.014	0.014	0.259	0.008	0.019
K=4	0.030	0.013	0.011	0.011	0.251	0.010	0.018
K=5	0.028	0.014	0.007	0.006	0.240	0.011	0.015
K=6	0.025	0.014	0.002	-0.002	0.229	0.012	0.011
Simple Avg.	0.026	0.006	0.011	0.009	0.251	0.006	0.015
Percent of Explained Variation	8.1%	1.9%	3.3%	2.7%	77.4%	1.9%	4.7%

Next, beta coefficients from the 64 combinations (from regressions of a given variable group by itself plus the 63 additional contributions of that variable group in all possible combinations with the other variable groups) for each variable for all three regressions were averaged to get the standardized impact from each variable within each group in order indicate the relative importance of the respective variable within the group. The results for the statistically significant variables in each regression are displayed in Tables 5-7.

The absolute value size of the average standardized beta coefficients shows that the largest per standard deviation influence on population growth was the average temperature in January, which was followed by the Census Division 5 dummy variable, both having household amenity interpretations in the base case (Table 1). In terms of industry composition, the most influential variable group for population growth, the influence primarily occurred through area concentration of employment in the mining and manufacturing industries (given their large standard deviations shown in Table 1). Negative policy differences appeared to be more

TABLE 5. Significant Beta Coefficients—Population Regression

Amenity		Demographics		Education	
TempJan	0.4821	*PCMrdHH90*	0.2664	*%Bachelors90*	0.2572
CCTypogC	0.1132	*%Age5064*	0.2048		
Humidity	-0.1958	*BirthRate90*	0.1508		
TempJuly	-0.2358	*%PopHisp90*	-0.1134		
Policy		**Industry**		**Geography**	
Cty92highway	0.1302	*%FarmJobs90*	-0.2112	*DistMA*	-0.1312
Cty92education	0.0527	*%AgServJobs90*	-0.0835	*IncDist250k*	-0.1435
Cty92safety	-0.1410	*%MfgJobs90*	-0.2010		
St92inctax	-0.1434	*%MinJobs90*	-0.2993		
St92hosp	-0.2112				
Census					
D5	0.4638				
D8	0.3404				
D6	0.2927				
D7	0.2103				
D4	0.1943				
D3	0.1704				

important than the variables positively associated with population growth in terms of the per standard deviation impact.

Consistent with the variance dominance analysis, the Census Division variables all have the largest impact on housing cost growth. Aside from the beginning period level of housing costs, the next largest impact occurs from the negative effect of a hotter July. Large negative effects also occur for greater distances from areas further up in the urban hierarchy.

Aside from the beginning period wage rate, the largest (absolute value) beta coefficient in the wage growth regression is for the average January temperature, while the average July temperature beta coefficient is the fifth largest. The second largest coefficient is for the Census Division 8 dummy variable. Other notable variables include: the initial employment share in manufacturing; the share of the adult population possessing a four-year college degree or higher; and the initial share of employment in construction.

5.3 Analysis of Regression Residuals

The final step of the analysis is to examine the residuals for patterns to suggest whether the influences on growth omitted from the regressions derive primarily from factors related to household amenity attractiveness, firm productivity, or housing supply. After substituting the reduced-form residuals into Equations (4)-(6), we compute correlation coefficients between these results and residual population growth. For example, if residual population growth is

TABLE 6. Significant Beta Coefficients –Rent Regression

	Amenity		Demographics		Education
Water	0.1016	*%Age5064*	0.1614	*%Bachelors90*	0.0036
TempJuly	-0.3653	*PCMrdHH90*	0.0593		
		%PopAsian90	-0.0714		
		BirthRate90	-0.1406		
		%PopHisp90	-0.1770		
		%Age65plus	-0.2834		
	Policy		Industry		Geography
Cty92highway	0.1325	*%MfgJobs90*	-0.0661	*Incmetgt500k*	-0.0255
RTW	0.1318	*%AgServJobs90*	-0.0670	*DistMA*	-0.1267
Cty92education	0.0336	*%Unempl90*	-0.1004	*IncDist250k*	-0.1890
Cty92sales	0.0239	*%GovJobs90*	-0.1646		
St92sales	-0.0636	*%MinJobs90*	-0.2623		
St92pblsfty	-0.1115	*MGR90*	-0.3731		
	Census				
D3	1.2022				
D4	0.9807				
D5	0.8848				
D8	0.8839				
D9	0.8374				
D6	0.8363				
D7	0.7421				
D2	0.3799				

TABLE 7. Significant Beta Coefficients –Wage Regression

	Amenity		Demographic		Education
TempJuly	0.1783	*%PopBlack90*	0.1187	*%Bachelors90*	0.1945
Water	0.0991	*%Age2549*	0.0802		
TempJan	-0.3987				
	Policy		Industry		Geography
St92highway	-0.1174	*%MfgJobs90*	0.2011	*IncDist500k*	-0.0740
		%ConstJobs90	0.1601	*IncDist1500k*	-0.0932
		%AgServJobs90	-0.1060	*IncDist250k*	-0.0963
		%Unempl90	-0.1519		
		AvgWage90	-0.5793		
	Census				
D8	0.2175				
D9	0.1012				

TABLE 8. Residual Analysis

	Residual Population Growth	p-value
Residual Amenity Effect	0.067	0.132
Residual Productivity Effect	0.175	<0.001
Residual Housing Effect	-0.202	<0.001

strongly correlated with residual (nominal) wage growth, we would conclude that there were sizable omitted productivity influences on growth [Equation (4)]. If instead, residual population growth were more negative correlated with real wage residuals [Equation (5)], we would conclude there were mostly omitted natural amenity influences on growth.

As shown in Table 8, residual population growth best fits a pattern of unexplained productivity-based growth, though the correlation coefficient is modest. This is followed by unexplained natural amenity-based growth. Unexplained housing supply growth is negatively correlated, suggesting an absence of unexplained factors, or that they are dominated by the other influences.

6. SUMMARY AND CONCLUSION

This study examined the determinants of variation in micropolitan area growth during the 1990s. Using the spatial growth framework of Glaeser and Tobio (2008), the study assessed the influence of factors related to household amenities, firm productivity and housing supply. Both patterns in regression coefficients and residuals from estimated reduced-form regressions for population growth, housing cost growth and wage growth were examined in the assessment.

As a group, industry composition was the most important source of variation in micropolitan area population growth. Stronger growth was associated with larger employment shares in farming and smaller shares in agricultural and forestry and fishery services, manufacturing, and mining. There was a negative significant effect on wages for agricultural and forestry and fishery services, suggesting adverse productivity effects. Significant negative effects on housing costs were found for mining and manufacturing and a positive wage effect for manufacturing, suggesting that larger employment shares in these industries negatively affected household amenity attractiveness. The manufacturing result, however, may have in part been the result of adjustments by firms to international trade shocks (Autor et al., 2011).

Census Division dummy variables had the second largest contribution to the adjusted r-squared for population growth. Based on the patterns of Census Division coefficients in the three regressions, differences in productivity primarily underlied the Census Division effects, particularly for the Mountain and Pacific states, which also had the most restrictive housing constraints or policies. The coefficients also were consistent with differentials in Census Division household amenity attractiveness, but to a lesser extent. Nevertheless, the single most important populaton growth variable in terms of per standard deviation impact was the average January temperature. In contrast to the findings by Glaeser and Tobio (2008) for metropolitan areas in the Sunbelt, housing supply factors had the least influence of the three sources for the Census Division differences. Yet, their study focused soley on the Sunbelt, which does not correspond to a Census division, relative to the average of all other areas; whereas, in the current

study individual division effects were estimated, and significantly more variables were included in the regressions, including measures of natural amenities.

The third most influential group of variables on population growth was state and local policy variables. Among these variables, the largest positive effects were from county spending on education and highways, which were interpreted as both positively influencing the household amenity attractiveness and productivity of the area. The only significant negative tax effect was from state income taxes.

Other variables having large individual impacts included the distance of a micropolitan area from the nearest metropolitan area and the incremental distance to a metropolitan area greater than 250,000 in population. Combined with the significant influence of these two variables on wage growth, this reveals increasing productivity disadvantages of remote micropolitan areas, consistent with the evidence of Partridge et al. (2010) for nonmetropolitan areas. The variables, along with the incremental distance to a metropolitan area with more than 500,000 people, sufficiently reduced housing cost growth as well to suggest more pro-growth housing supply policies in remote areas, a factor not considered in previous studies.

Therefore, although we do not confirm the findings of Glaeser and Tobio (2008) regarding the dominance of pro-growth housing policies for growth in the U.S. South, we confirm their importance in assessing growth differences generally. Despite increasing productivity disadvantages in more remote areas, capitalizing on amenity attractiveness, and pro-growth housing supply policies through local zoning and permitting, are policy options in remote areas. Yet, as suggested in Rickman and Rickman (2011), areas rich in natural amenities need to exercise caution in promoting population growth because of potential adverse growth impacts on the quality of life that negatively feed back onto growth. Growth differences in general may only be temporary as areas move towards spatial equilibrium and location advantages become capitalized into factor prices, though long-lasting or permanent changes in measures of well-being may result (Partridge and Rickman, 2003b).

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APPENDIX
Descriptive Statistics and Sources

Dependent Variables	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**	**Data Source**
Population 90-00	511	9.3	11.2	-17.1	73.6	US Census
Medan Rent 90-00	511	54.6	19.2	-2.8	133.7	US Census
Avg. Wages 90-00	511	40.7	11.1	-2.9	97.9	US Census
Lagged Variables						
Population Density 1990	511	62.38	41.68	1.787	265.301	US Census
Median Rent 1990	511	325.60	86.99	176.915	906.013	US Census
Average Wages 1990	511	16.88	2.38	10.4361	29.0493	US Census
Amenity Variables	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**	**Data Source**
Humidity	*511*	57.10	13.69	18	79	USDA
Land Surface Form Typography codes:	511	8.49	6.67	1	21	USDA
Mean January Temperature	511	33.08	11.69	3.1	63.4	USDA
Mean July Temperature	511	75.79	5.38	55.9	86.7	USDA
Water Sq. Miles	511	3.87	8.95	0.01	66.13	US Census
Demographic Variables	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**	**Data Source**
Births per 1,000 population 1990	511	14.88	2.40	9.1	26.4	US Census
Percent African American 1990	511	8.71	13.87	0	64.6	US Census
Percent Asian American 1990	511	0.52	0.48	0.04	3.57	US Census
Percent Hispanic American 1990	511	4.31	10.94	0.2	84.4	US Census
Percent of Married Households 1990	511	59.39	4.68	42.5	73.3	US Census
Percent of Population in over 65 or Older 1990	511	14.51	2.88	5.1347	31.3137	US Census
Percent of Population Age 25-49 in 1990	511	34.51	2.35	26.1	46.7	US Census
Percent of Population Age 50-64 in 1990	511	13.66	1.57	7.8	20.9	US Census

APPENDIX (Continued)

Demographic Variables	Obs	Mean	Std Dev	Min	Max	Data Source
Educational attainment - persons 25 years and over - Bachelor's, Master's, or Professional degree 1990	511	13.27	4.50	5.5	36.3	US Census
Educational attainment – % of - persons 25 years and over who are high school graduates or higher 1990	511	69.75	8.68	42.9	89.1	US Census
Presence of a Land Grant University	511	0.03	0.17	0	1	Association of Public and Land Grant Universities

Policy Variables	Obs	Mean	Std Dev	Min	Max	Data Source
Local Per Capita Sales Tax Revenues 1992	511	0.00	0.00	0	0.023533	US Census
Local Per Capita Spending on Health Care 1992	511	0.01	0.00	0.00435	0.015885	Economic Census 1992
Local Per Capita Spending on Highway Infrastructure 1992	511	0.01	0.00	0.000622	0.024515	Economic Census 1992
Local Per Capita Spending on Public Education 1992	511	0.05	0.01	0.02926	0.13888	Yu and Rickman (forthcoming)
Local Per Capita Spending on Public Safety 1992	511	0.01	0.00	0.000804	0.021972	Economic Census 1992
Local Per Capita Property Tax Revenues 1992	511	0.03	0.01	0.00371	0.09937	US Census

APPENDIX (Continued)

Policy Variables	Obs	Mean	Std Dev	Min	Max	Data Source
State Per Capita Spending on Highway Infrastructure 1992	511	0.01	0.00	0.007904	0.039311	Economic Census 1992
State Per Capita Spending on Public Safety 1992	511	0.01	0.00	0.007207	0.021361	Economic Census 1992
State Per Capita Corporate Income Tax Revenues 1992	511	0.00	0.00	0	0.0097879	Economic Census 1992
State Per Capita Income Tax Revenues 1992	511	0.02	0.01	0	0.039943	Economic Census 1992
State Per Capita Property Tax Revenues 1992	511	0.03	0.01	0.010091	0.060725	Economic Census 1992
State Per Capita Sales Tax Revenues 1992	511	0.02	0.01	0	0.051105	Economic Census 1992
Industrial Variables	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**	**Data Source**
Employment Share in Ag-Service: as % of Total Jobs	511	1.20	1.11	0	12.6	US Census
Employment in Farming: Percent of Total Jobs	511	6.26	3.64	0.4	20.8	US Census
Jobs in Construction: as % of Total Private Nonfarm Jobs	511	4.77	1.78	0	14.9	US Census
Jobs in Government: as % of Total Employment	511	16.87	7.46	6.9	60.8	US Census
Jobs in Manufacturing: as % of Total Employment	511	18.35	10.25	1.3	47.6	US Census

APPENDIX (Continued)

Industrial Variables	Obs	Mean	Std Dev	Min	Max	Data Source
Jobs in Services: Percent of Total Private Nonfarm Jobs	511	21.08	5.33	0	37.2	US Census
Jobs in Mining: Percent of Total Private Nonfarm Jobs	511	1.54	3.35	0	25.2	US Census
The Unemployment Rate	511	7.07	2.39	1.9	15.7	US Census

Geographic Variables	Obs	Mean	Std Dev	Minimum	Maximum	Data Source
Distance to Next Metropolitan area	511	78.42	45.92	17.011	334.945	Partridge et al, 2010
Incremental Distance to the Next Metropolitan Area with a Population of 1.5 million or less	511	98.86	117.95	0	532.302	Partridge et al, 2010
Incremental Distance to the Next Metropolitan Area with a Population of 500,000 or less	511	34.42	55.11	0	362.772	Partridge et al, 2010
Incremental Distance to the Next Metropolitan Area with a Population of 250,000 or less	511	47.16	79.87	0	601.043	Partridge et al, 2010

Census Division Variables	Obs	Mean	Std Dev	Minimum	Maximum	Data Source
Census Divisions 2-9	511	-	-	0	1	US Census