Human Capital, Quality of Life, and the Adjustment Process in American Metropolitan Areas

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Abstract. This paper presents a locational analysis of growth and change within the American constellation of metropolitan areas. It begins with the premise that the development process happens in two interconnected ways: Via demand-induced growth, which is driven by economic opportunity, and supply-induced growth, which is driven by personal preference. The nature and spatial outcome of these mechanisms are investigated by estimating a series of three-equation regional adjustment models wherein changes in population density, employment density, and the average annual wage are endogenously determined. In order to account for spatial dependence in the development process, each model is specified with spatial lags of its three dependent variables and is estimated using a spatial two-stage least squares technique. The results of the analysis illustrate the evolving nature of the adjustment process and yield insight into the land use patterns that it produces.

1. Introduction

The process of regional development happens in two interconnected ways (Borts and Stein 1964). First, *demand-induced growth* occurs when firms require additional labor, causing an increase in the demand for workers. The classic example of this is when an export-oriented employer increases production and people move from elsewhere to fill newly created jobs, but, increasingly, it also results from changes in the nature of the human capital that is needed; the Puget Sound region of Washington State, for instance, was once dominated by the aerospace industry surrounding Boeing but is now dominated by the software industry surrounding Microsoft. Second, *supply-induced growth* occurs when households move from one place to another for reasons that do not have to do with employment, causing an increase in the supply of labor. People of all occupations, from low-wage baristas to high-wage professionals, commonly relocate for quality of life related reasons and, whether this is done with complete disregard for work or not, personal preference, rather than economic opportunity, is the main motivation. Just as the jobs created by the Puget Sound's many high-performing companies draw a steady stream of newcomers, so too do its unique culture, natural beauty, and temperate climate. These two mechanisms and the interplay between them form what Muth (1971) originally characterized as a *chicken-or-egg* pattern of migration, where growth occurs as a result of people and jobs following each other from place to place.

Regional adjustment models traditionally portray this relationship as a system of two simultaneous equations wherein population (employment) change between two points in time is a function of employment (population) at the end of the time period, population (employment) at the beginning of the time period, and a set of other initial conditions. The approach has become a popular method of analyzing inter- and intraregional migration patterns because it explicitly accounts for the roles of both opportunity and preference, plus the interaction between them. Although the exact balance of demand- and supply-induced growth differs across regions, spatial frames of reference, and time periods, it is evident that some combination of two is what accounts for the distribution and configuration of economic activity throughout the United States (Steinnes and Fisher 1974; Carlino and Mills 1987; Boarnet 1994a, 1994b; Clark and Murphy 1996; Henry et al. 1997, 1999, 2001; Glavac et al. 1999; Mulligan et al. 1999; Vias and Mulligan 1999; Deller et al. 2001; Bao et al. 2004; Carruthers and Vias 2005; Boarnet et al. 2006a, 2006b; Carruthers et al. 2006; Mulligan and Vias 2006; Carruthers and Mulligan 2007).

The theory underpinning regional adjustment models is a *compensating differentials* framework that characterizes migration as a spatial response to economic opportunity, in the form of employment, higher wages, and/or other means of advancement, and personal preference, for particular amenities, lifestyles, and/or other quality of life improvements. Within this context, population and employment dynamically adjust via a process that eventually produces a steady state where, in net, change no longer occurs. If this point were ever reached, no place would have an advantage over another because all households and firms would be located in such a way that their utility and profits, respectively, were maximized. Even though economic expansion and related movement would continue to occur, all else being the same, they would do so in a way that did not alter the relative distribution or configuration of activity. In other words, at a particular equilibrium, the ratios of population to employment and the amounts of space each occupies remain constant indefinitely. The balance remains static because, if any individual actor could improve their situation by altering the system in some way, they would do so. Viewed from this perspective, all contemporary regional development, whether demand- or supply-induced, represents a locational adjustment made by the space economy as it searches for an optimal arrangement of activity (Lösch 1954; Isard 1956; Fujita et al. 1999). In practice, new shocks to the system make the ideal situation a perpetually moving target so, while theoretically attainable, it is never actually achieved. The reality is that, as time passes, opportunities change, preferences evolve, and the trajectory of development steadily shifts (Partridge and Rickman 2003, 2006). So, while migration is best viewed as a response to spatial disequilibrium, or a condition in which households and/or firms are not optimally located, it may be that the overall system is, in fact, never far from equilibrium and only minor corrections are needed to get there. In this way, the kind of *moving equilibrium* (Graves and Linneman 1979; Graves and Mueser 1993; Mueser and Graves 1995) that regional adjustment models emulate reflects the empirical dichotomy that, at any given time, the space economy exhibits many steady state characteristics but, nevertheless, remains in a state of constant flux.[1]

The implications of all of this for empirically modeling adjustments to the arrangement of population and employment within a network of metropolitan areas are several. First, if the regional development process is truly bidirectional, then mediating factors that influence the decisions of both households and firms should make a difference. Second, because they involve separate—or, at least, separable—motivations, it is likely that supply- and demand-induced growth do not produce the same spatial outcomes. Third, as already noted, there is every reason to believe that the balance of the two mechanisms shifts through time, so equilibrium conditions depend, in part, on from when they are projected. Fourth, it makes sense to look for this steady state movement over relatively short time periods, particularly when the guiding principle is that

[1] The authors are indebted to an anonymous referee for highlighting this point.

preference continues to gain on opportunity as a catalyst for growth and change (Carruthers and Mulligan 2006). Last, when modeling spatial outcomes, there is merit to looking beyond population and employment toward wages in order to capture how they influence, and are influenced by, the pattern of land use.

In the United States, it seems important to know more about each of these things because the adjustment process has been more-or-less cemented by an industrial transition away from manufacturing toward high-order services. In particular, the rise of the so-called *information economy*, composed primarily of producer services and advanced consumer services (see Drennan 2002), has led to unprecedented mobility for households and firms alike. As a result, regions progressively, and, at times, very rapidly, become winners or losers based on their comparative desirability both as places to live and do business. Not only are people drawn to locations that offer economic opportunity, jobs are drawn to locations that appeal to personal preference, so each form of growth needs to be explored. How do demand- and supply-induced growth mechanisms impact the spatial pattern of development? Are human capital factors, which matter to firms, and quality of life factors, which matter to households, equally important? How has the adjustment process changed through time? And, finally, what are the implications for public policies aimed at shaping the outcome of development? The following analysis investigates these questions.

2. Modeling Framework

A regional adjustment model is an application of the *partial adjustment model*, a type of autoregressive model that was originally developed for analyzing problems related to business cycles (see, for example, Litner 1956; Griliches 1967; Lev 1969). The framework improves upon conventional distributed lag models, which often rely heavily on poorly justified assumptions about the structure of time-dependent processes, by characterizing changes in the dependent variable as a dynamic, or perpetually moving, process of adjusting toward a targeted equilibrium level:

$$\dot{q} = (q_t / q_{t-}) = \delta_q (\tilde{q} / q_{t-}) \quad (1)$$

In this equation, $t-$ and t represent two successive points in time; $\dot{q}$ represents a rate of change in a variable that dynamically adjusts toward equilibrium through time; $\tilde{q}$ represents the (mobile) equilibrium level of that variable; and δ_q represents a fractional adjustment parameter that, within the context of economic growth, is negatively related to the initial level of q (Barro and Sala-i-

Martin 1991, 1992). In this set up, the rate of change in q is equal to the product of the adjustment parameter and the ratio of its equilibrium and past levels, so the actual level of the variable at time t may be described as the weighted average of the two. From this point of departure, regional adjustment models posit that population density (p) and employment density (e) adjust toward an unknown point of spatial equilibrium and that, along the way, they are endogenously determined, producing a system of two simultaneous equations (Steinnes and Fisher 1974; Carlino and Mills 1987; Boarnet 1994a, 1994b).

The model used in this paper expands on the traditional two-equation framework by adding a third equation and endogenous variable, for the average annual wage (y), to the system. The logic of the three-equation version is analogous to DiPasquale and Wheaton's (1996) three-sector model of metropolitan growth, which links the local export, labor, and real estate markets. As described in the opening paragraph, demand-induced growth occurs as a result of firms needing additional labor and supply-induced growth occurs as a result of households making moves for quality of life related reasons. Only the first of these two mechanisms is precipitated by gains in the export market but both clearly place pressure on the real estate market, raising rents and, at the same time, densities as a result of greater competition over space (Alonso 1964). Expressing population and employment in terms of the density of land use—people and jobs per acre of occupied, or developed, space—ties the adjustment process directly to land value and clarifies the reasoning behind the wage equation. In particular, densities measure the spatial intensity of activity, which is influenced by the average annual wage because of its relationship to land consumption: From the perspective of utility-maximizing households, land is a normal good, so, the more they earn in wages, the more space they are able to consume, leading to a lower population density; conversely, from the perspective of profit-maximizing firms, land is a factor of production, so, the more they pay out in wages, the less space they are able consume, leading to a higher employment density. Meanwhile, population density, which measures how concentrated the supply of labor is, and employment density, which measures how concentrated the demand for labor is, simultaneously drive the average annual wage. Building on Roback's (1982) model of compensating differentials, Mueser and Graves (1995) show mathematically how labor demand, labor supply, and wages combine to form a moving equilibrium that calls for more-or-less continuous migration as the space economy wobbles along a path of constant, interactive change, searching for an optimal organization of activity.

Picking up from equation (1), the rates of change for population density ($\dot{p}$), employment density ($\dot{e}$), and the average annual wage ($\dot{y}$) are described via an identical set of adjustment relationships:

$$\dot{p} = (p_t / p_{t-}) = \delta_p (\tilde{p} / p_{t-})$$
$$\dot{e} = (e_t / e_{t-}) = \delta_e (\tilde{e} / e_{t-}) \quad (2)$$
$$\dot{y} = (y_t / y_{t-}) = \delta_y (\tilde{y} / y_{t-})$$

Just like before, the values observed at time t lie somewhere in between their values at time t- and their equilibrium values, $\tilde{p}$, $\tilde{e}$, and $\tilde{y}$, and δ_p, δ_e, and δ_y represent unique parameters that are less than zero and greater than negative one, implying a process of convergence toward spatial equilibrium (Rey and Janikas 2005; Arbia 2006). The core of the system of relationships described in the preceding paragraph is created by specifying that each variable's observed rate of change toward that point is a function of the observed level of the other two at time t, its own level at time t-, and a set of other initial conditions:

$$\dot{p} = \alpha_0 + \alpha_1 p_{t-} + \alpha_2 e_t + \alpha_3 y_t + \boldsymbol{\alpha}_4 \boldsymbol{x}_{pt-} + \varepsilon_{pt}$$
$$\dot{e} = \beta_0 + \beta_1 p_t + \beta_2 e_{t-} + \beta_3 y_t + \boldsymbol{\beta}_4 \boldsymbol{x}_{et-} + \varepsilon_{et} \quad (3)$$
$$\dot{y} = \gamma_0 + \gamma_1 p_t + \gamma_2 e_t + \gamma_3 y_{t-} + \boldsymbol{\gamma}_4 \boldsymbol{x}_{yt-} + \varepsilon_{yt}$$

Here, the αs, βs, and γs represent estimable parameters where α_1, β_2, and γ_3 stand in for δ_p, δ_e, and δ_y, respectively; the $\boldsymbol{x}$s represent vectors of initial conditions; and ε_{pt}, ε_{et}, and ε_{yt} represent random error terms. This model produces identical estimation results if the dependent variables are expressed as levels instead of rates of change—except that the three adjustment parameters are instead equivalent to $1+\alpha_1$, $1+\beta_2$, and $1+\gamma_3$ and the adjusted R^2 values are unrealistically high (say, ~0.98 versus ~0.25).

Following from the discussion so far, it is expected upfront that, as the three dependent variables in equation set (3) dynamically adjust: Population density is positively influenced by employment density and negatively influenced by the average annual wage; employment density is positively influenced by population density and positively influenced by the average annual wage; and the average annual wage is negatively influenced by population density and positively influenced by employment density. In plain terms, both demand- and supply-induced growth raise land values and, in the process, produce greater densities,[2] but, while the former raises wages by making labor more scarce, the latter lowers them by making labor less scarce. Meanwhile, wage growth lowers population density by causing households to consume more land and raises employment density by causing firms to consume less land. Within this framework, human

[2] A land value equation involving the same land use data used to calculate densities in this analysis and roughly the same set of counties produces and adjusted R^2 of 0.86, indicating that land use density and land rent are closely—and endogenously—related, even when examined from an interregional perspective (Ulfarsson and Carruthers 2006).

capital and quality of life factors are hypothesized to promote spatial clustering in the form of higher densities by acting as magnets for population and employment growth. At the same time, the former group of factors is expected to promote wage growth through productivity and knowledge effects and the latter is expected to slow it through amenity effects. Detailed explanations of the thinking behind these expectations are contained in, for example, Capello and Nijkamp (2004), Henderson and Thisse (2004), and Carruthers and Mundy (2006).

3. Econometric Specification and Data

The empirical analysis involves all 329 metropolitan areas (1999 definition) located in the continental United States during three five-year time periods: 1982 – 1987, 1987 – 1992, and 1992 – 1997. As shown in Figure 1, these regions are formed around a constellation of 831 counties, the actual unit of analysis, which are mapped as points placed at the geographic centers of their populations in 1990 (see Carruthers et al. 2006). Inspection of the map strongly suggests that an econometric analysis of these population centers needs to account for the spatial process through which they develop (Cliff and Ord 1981; Anselin 1988; Anselin et al. 2004; Arbia 2006). Specifically, because most metropolitan areas are made of multiple counties that influence one another's growth and/or are clustered together into very large supra-regions like the Northeast corridor, it is necessary to account for *spatial dependence* in the data representing population density, employment density, and the average annual wage. This is accomplished by adding spatial lags to equation set (3) to arrive at a final structural model of metropolitan growth and change:

$$
\begin{aligned}
\dot{p}' &= \alpha_0 + \rho_{pt} W p'_t + \alpha_1 p'_{t\text{-}5} + \alpha_2 e'_t + \alpha_3 y'_t + \boldsymbol{\alpha}_4 \boldsymbol{x}_{pt\text{-}5} + \varepsilon_{pt} \\
\dot{e}' &= \beta_0 + \rho_{et} W e'_t + \beta_1 p'_t + \beta_2 e'_{t\text{-}5} + \beta_3 y'_t + \boldsymbol{\beta}_4 \boldsymbol{x}_{et\text{-}5} + \varepsilon_{et} \\
\dot{y}' &= \gamma_0 + \rho_{yt} W y'_t + \gamma_1 p'_t + \gamma_2 e'_t + \gamma_3 y'_{t\text{-}5} + \boldsymbol{\gamma}_4 \boldsymbol{x}_{yt\text{-}5} + \varepsilon_{yt}
\end{aligned}
\qquad (4)
$$

All of the notation in the these equations is the same as above, except that, following previous research (Carruthers and Vias 2005; Carruthers et al. 2006; Carruthers and Mulligan 2007), the ′s indicate that the core variables are expressed in natural log form; *t*-5 and *t* denote the beginning and end years of the three time periods; W is an 831 × 831 ($n \times n$) row-standardized queen contiguity spatial weights matrix; and ρ_{pt}, ρ_{et}, and ρ_{yt} are estimable parameters measuring the influence of the spatially lagged levels of the three dependent variables. As already pointed out, the empirical model produces identical results when the dependent variables are expressed as levels instead of rates of change; adding the spatial lags does not change this.[3]

Note here that the spatially lagged variables shown in (4) are endogenous because they indicate that the three dependent variables for any given county, *i*, are influenced by the weighted average of their levels in all adjacent counties, *j* (Rey and Boarnet 2004). That is, the rates of change in population density, employment density, and the average annual wage in county *i* depend on the level of these variables in counties *j* and the other way around. Because of its complicated set of interdependencies, the model cannot be properly estimated with ordinary least squares (OLS) so, instead, a *spatial two-stage least squares* (S2SLS) strategy developed by Kelejian and Prucha (1998) is used.[4] The first stage of the procedure involves regressing Wp_t, We_t, and Wy_t on instruments created using an approach based on the *three-group method*, where the instrumental variable is assigned a negative one, zero, or one depending on whether the value of the original variable is in the bottom, middle, or top third of its ordinal ranking (Kennedy 2003), plus $\boldsymbol{x}_{t\text{-}5}$ and $W\boldsymbol{x}_{t\text{-}5}$, to produce predicted values of the spatial lags (see, for example, Fingleton and López-Bazo 2003; Fingleton 2005; Fingleton et al. 2005). The second stage of the procedure then uses the predicted values in place of the actual values of to arrive at the final parameter estimates. In practice, the system of equations already requires an estimator that handles endogeneity, so all of the interdependent variables end up being regressed on $\boldsymbol{x}_{t\text{-}5}$, $W\boldsymbol{x}_{t\text{-}5}$, and a set of additional instruments specific to each in a single S2SLS estimation process.

In order to implement the procedure just described, it was necessary to collect data for the 831 counties that are the object of the analysis—plus certain data for an additional 1,196 surrounding counties. Figure 2, a map of all 2,027 counties involved, displays the geographic scope of the database. To be clear, only the metropolitan counties (shown in dark grey) are included as observations, but data from adjacent nonmetropolitan counties (shown in light grey) was needed to calculate the spatially lagged dependent variables plus complete $W\boldsymbol{x}_{t\text{-}5}$ vectors, which are required as instruments by the S2SLS procedure.

Four cases of the empirical model corresponding to different $\boldsymbol{x}_{t\text{-}5}$ vectors are examined. Case 1 is the core model containing a single initial condition, aggregate size in quadratic form, plus a central city indicator and longitude and latitude coordinates to control for the influence of location in-and-of itself. Case 2 is the core model with initial industrial composition, measured

[3] The spatial weights matrix and all spatially weighted variables were created using *GeoDa* (Anselin 2003; Anselin et al. 2006)

[4] A true systems, or *spatial three stage least squares* (S3SLS), version of this estimator is also available (Kelejian and Prucha 2004), but a decision was made not to use it for the present analysis due to the exploratory nature of the work. Because the S3SLS enables correlation among error terms, specification errors can end up reverberating through the

via the share of total non-farm earnings in the finance, insurance, and real estate (FIRE), manufacturing, and service sectors. Case 3 is the core model with initial industrial composition, plus four additional initial conditions representing human capital factors: The percentage of the working-aged population with a high school education; the percentage of the working-aged population a college education, the per capita number of educational institutions, and per capita public spending on education and libraries. Last, Case 4 is the core model with initial industrial composition, plus four additional initial conditions representing quality of life factors: A composite natural amenity index, the per capita number of entertainment establishments, the the per capita number of eating and drinking establishments, and per capita public spending on parks and recreation. Unfortunately, it was not possible to meaningfully examine a fifth case with both the human capital and quality of life variables included, due to severe problems with multicollinearity.[5] The exact definition and source of each variable involved in the analysis are given in Table 1.

All of the variables contained in the empirical models except for longitude and latitude are expressed as location quotients, or the ratio of, say, x to $\bar{x}$. The reason for the transformation is that, by convention, regional adjustment models are evaluated on the basis of their characteristic roots and characteristic vectors—the former addresses the dynamic stability of the system and the latter reveals the estimated ratio of population to employment to the average annual wage at equilibrium. For present purposes, these tests are done by decomposing a 3×3 matrix of reduced form adjustment parameters in order to ascertain that the dominant characteristic root is less than one and that the characteristic vector reflects a fractionally reasonable growth path. The three-equation model has the added wrinkle that equilibrium densities, measured in people and jobs per acre of developed land, must be compared to wages, measured in dollars. Expressing these variables as location quotients, which describe the spatial concentration of activity in a unit free way, overcomes the problem of having to compare apples to oranges and enables meaningful analysis of the steady state solutions. Descriptive statistics for the all of the transformed variables, calculated from data for the 831 metropolitan counties, are listed in Table 2; the dependent variables shown in equation set (4) are just values at time t divided by their values at time t-5.

Finally, as mentioned throughout the discussion so far, population and employment densities are calculated using land use data, so the variables correspond to occupied space and, as

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entire set of equations. The analysis that follows deals with a number of alternative specifications, none of which are intended to be complete, so it deliberately avoids using an actual systems approach.

importantly, they change over time. Previous research demonstrates that using a measure of developed land—in this case, via the USDA's *National Resources Inventory* (NRI)—in the denominator of the density calculations significantly enhances the performance of regional adjustment models. Specifically, with land use data, the models produce more reliable estimates than traditional specifications, which usually use county land area or some other, more arbitrary spatial unit (Carruthers and Vias 2005; Boarnet et al. 2006a, 2006b; Carruthers and Mulligan 2007). And, because land use changes through time, this form of measurement allows the arrangement of activity to evolve and better addresses the kind of moving equilibrium regional adjustment models are meant to portray.

4. Estimation Results

The empirical model was estimated in *EViews*, an econometrics program, for the four cases and each of the three five-year time periods between 1982 and 1997; in all, a total of 12 three-equation systems were estimated. The data is for 831 counties representing 329 metropolitan areas so, in order to correct for heteroskedasticity emanating from that upper level of geography, panel settings within the software were used to develop White-adjusted standard errors clustered by the region to which they belong.[6] The results are reported in Tables 3 – 6, where the -a, -b, and -c suffixes correspond to the 1982 – 1987, 1987 – 1992, and 1992 – 1997 panels, respectively. Nearly all of the models' explanatory variables are statistically significant and their equations' adjusted R^2s are consistent with those of other change-based regional adjustment models. The next paragraphs summarize the estimation results for each of the four cases.

In Case 1, reported in Tables 3a – 3c, the core variables all carry their expected signs and, except for certain variables in the 1987 – 1992 panel, are statistically significant at well over a 99% confidence interval. The middle panel is centered squarely on a recession, which, according to the National Bureau of Economic Research's dating procedure, ran from July 1990 to March 1991, so it may well be that the contraction of the United States economy as a whole explains the breakdown of the adjustment process during that time. It is interesting, too, to note that the spatial lags, which are highly significant in all but one instance, are negative in the employment density equation, due to the presence of distance gradients. Whereas the levels of population density and the average annual wage positively influence their rates of change in surrounding counties, the

[5] The individual models were also estimated with measures of local taxation (per capita total tax and the percentage of total taxes that comes from property taxes) included but the results for these variables were inconsistent and ambiguous, so they were excluded from the final specification.
[6] The authors thank Ray Florax for recommending this approach to dealing with spatial hetreoskedasticity.

level of employment density negatively influences its rate of change surrounding counties. The lone initial condition, total size in quadratic form, is highly significant in most instances: The positive sign on the first term and the negative sign on the second term together indicate that initial size has an inverted *u-shaped* influence that first rises, then falls in magnitude. As a baseline, the maximum points of the equations' quadratic functions—calculated as the value of the first coefficient divided by the value of second coefficient multiplied by negative two, or, say, $\alpha_{size} / -2\alpha_{size^2}$—consistently indicate that regions have to be about 20 times larger than the national average, or about the size of Cook County, Illinois, which contains the City of Chicago, before the positive influence of metropolitan agglomeration finally begins to taper off. Reading further down the list of explanatory variables, the central city indicator shows that, in all three of the panels, downtown areas experienced slower rates of change in population density and the average annual wage but higher rates of change in employment density. These results are entirely consistent with well known patterns of central city decline during the study period. As for the influence of location in-and-of itself, longitude grows more negative toward the west and latitude grows more positive toward the north, so positive (negative) signs on these variables indicate that eastern and northern (western and southern) locations experience higher rates of change and western and southern (eastern and northern) locations experience lower rates of change. The shifting sign pattern on these two explanatory variables across the three panels reflects the fact that migration flows in the continental United States drifted, sometimes dramatically, during the 1980s and 1990s (Plane 1999). In general, all of these overarching findings hold for the three expanded cases.

In Case 2, reported in Tables 4a – 4c, the estimated parameters on employment density across all three equations are smaller than before because the model holds the types of jobs in question constant. Comparing the industrial sectors through time reveals that, over the course of the three panels, the share of earnings in FIRE emerges as a positive and increasingly powerful force of metropolitan growth and change; the share of earnings in manufacturing has a negative effect or no effect at all until the final panel, where it positively influences the rates of change in employment density and the average annual wage; and the share of earnings in services only has a positive effect on the rate of change in employment density, though the magnitude of this influence oscillates quite a bit over the course of the three panels. Overall, the results for the industrial composition variables line up well with extant knowledge about how the transition away from manufacturing toward high-order services has affected the American space economy, primarily in the sense that they confirm that regions stand to benefit from specializing in high-order producer and consumer services (Drennan 1999, 2002).

In Case 3, reported in Tables 5a – 5c, four human capital factors are added to the mix of variables contained in Case 2. Here, there is some evidence that concentrations of high school- and college-educated people—where the count of the former excludes the latter, so there is no double counting—lead to spatial clustering of development by positively influencing the rates of population and employment density change. The first of the two variables may also mediate the direct effect of labor supply in the wage equation by accounting for the relative availability of people with skills. Next, the per capita number of educational institutions negatively influences population density but, when statistically significant, positively influences employment density and the average annual wage. Last, the measure of per capita spending on education and libraries registers a fairly consistent positive influence in the population density and wage equations but, curiously, a negative influence in the employment density equation. Broadly, the results for this series of models lend support to the hypothesis that human capital factors matter to the adjustment process, but the differences to the coefficients on the core variables are not as large as anticipated, given kind of learning and productivity growth that dense metropolitan economies are known to promote (Glaeser and Maré 2001). In addition, it is unclear why the variables do not unambiguously promote spatial clustering given the attractiveness of large metropolitan areas to highly educated households (Costa and Kahn 2000). For example, the proportion of college-educated people has no consistent effect on population density, but it may be that, after holding the average annual wage constant, the penchants of this group are bifurcated toward both high- and low-density living environments. A likely explanation for the lower rate of employment density change experienced by regions with high levels of public spending on education and libraries is that firms seek to avoid the tax burden associated with these services by locating outside of central cities and other fiscally burdened areas. As footnoted earlier, models containing measures of local taxation were also estimated, but these variables produced highly irregular results, so they were excluded from the final specifications.

In Case 4, reported in Tables 6a – 6c, four quality of life factors are added to the mix of variables contained in Case 2. The natural amenity index at first positively influences all three dependent variables but, by the time of the third panel, is reoriented and negatively influences the rates of change in employment density and the average annual wage. The latter effect is expected within the compensating differentials framework but so too is a positive, rather than negative, impact on the rates of density change, due amenities' influence on real estate values (Roback 1982). It may be, though, that the effects of climate and other natural features end up being adequately captured by the combination of longitude and latitude, because these variables are almost always statistically significant in this series of models. Another possible explanation for the negative sign in the employment density equation—which persists all the way through the three panels—is that, in terms of the natural environment, firms do not always like the same places as households (Gabriel and Rosenthal 2004), so land market competition may not be as intense as intuitively expected in high-amenity areas. Moving on, the per capita number entertainment establishments and the per capita number of eating and drinking establishments also have somewhat mixed effects. Based on Glaeser et al.'s (2001) *consumer city* hypothesis, these variables were expected to promote higher rates of density change but, instead, a more mottled picture emerges. When significant, the per capita number of entertainment establishments has a negative influence in the population equation and a positive influence in the employment and wage equations; the per capita number of eating and drinking establishments has basically the same spotty pattern of influence, except that it is consistently negative in the wage equation, suggesting that it represents an amenity. Meanwhile, apart from one negative sign in the population equation of the first panel, per capita public spending on parks and recreation appears to promote spatial clustering by positively influencing the rates of population and employment density change. Contrary to expectations, it does not seem to act as an amenity by negatively influencing the rate of change in the average annual wage. Like the findings associated with the human capital variables, these broadly support the hypothesis that quality of life factors matter to the adjustment process, though the coefficients on the core variables are, again, not impacted by their inclusion in the models as much as anticipated.

5. Characteristic Roots and Characteristic Vectors

As explained earlier, there are two tests that are used to evaluate and, ultimately, discriminate among regional adjustment models (Mulligan et al. 1999). The first of these is a test for dynamic stability, which reveals whether or not the models portray a steady state growth path and the second is a test for how reasonable that path is, which reveals whether or not the models' solutions are, in fact, realistic. By convention, these two tests are initiated by estimating new equations where all of the adjustment variables are lagged to time *t*-:

$$\begin{aligned}
\dot{p}' &= \xi_0 + \eta_{pt} W p'_t + \xi_1 p'_{t\text{-}5} + \xi_2 e'_{t\text{-}5} + \xi_3 y'_{t\text{-}5} + \boldsymbol{\xi}_4 \boldsymbol{x}_{pt\text{-}5} + \upsilon_{pt} \\
\dot{e}' &= \psi_0 + \eta_{et} W e'_{\mathrm{t}} + \psi_1 p'_{t\text{-}5} + \psi_2 e'_{t\text{-}5} + \psi_3 y'_{t\text{-}5} + \boldsymbol{\psi}_4 \boldsymbol{x}_{et\text{-}5} + \upsilon_{et} \qquad (5) \\
\dot{y}' &= \zeta_0 + \eta_{yt} W y'_t + \zeta_1 p'_{t\text{-}5} + \zeta_2 e'_{t\text{-}5} + \zeta_3 y'_{t\text{-}5} + \boldsymbol{\zeta}_4 \boldsymbol{x}_{yt\text{-}5} + \upsilon_{yt}
\end{aligned}$$

The notation here is essentially the same as before, except that the ξs, ψs, ζs, ηs, and υs replace the αs, βs, γs, ρs, and εs, respectively. For present purposes, a total of nine parameters are of interest for each model, where each shows a five-year lagged effect. In all instances, the own effect, measured by ξ_1, ψ_2 and ζ_3, is modified by adding a value of one to the parameter estimates, which range from zero to negative one, instead of zero to positive one, because the rate of change is being estimated on the left hand side. Once again, a total of 12 models were estimated via the same spatial two stage least squares procedure as before, producing a series of *growth matrices* (Rogers 1971) that were used to conduct the two tests.

For the first test, the three *characteristic roots* calculated for each of the four cases are shown at the bottom of the models' respective tables. In a pure mathematical sense, the dominant root, or λ_1, must be less than one in order for the system to be considered dynamically stable; otherwise, the estimates portray an unstable growth path that can lead to multiple and even conflicting steady state scenarios. Here, the dominant root for all four cases is very close to one, indicating that the systems of equations are at least in the vicinity of being dynamically stable. Even so, the only series of models that actually produces a characteristic root that is less than one is Case 4, in the final panel. Note that Cases 1 and 3 produce dominant roots that are less than one in the middle panel, but these are considered meaningless because the structural models each shoot at least one blank in the block of adjustment variables. Surprisingly, Case 3, containing the human capital factors, does not appear to hold any real advantage over Cases 1 and 2 in terms of dynamic stability—even though the dominant root gets marginally smaller in the third panel, when the adjustment process is expected to have taken a tighter hold due to the evolution of the space economy as a whole. This leaves Case 4, containing the quality of life factors, as the only series of models that eventually passes a strict application of the test for dynamic stability.

One plausible explanation for the models' shortfall in this regard is that their geographic scope is limited to metropolitan areas, so they do not capture the complete flow of migration, which, critically, includes moves to, from, and within nonmetropolitan areas as well. Yet another explanation is that the *boom and bust* business cycles driving the model produce systematic over- and undershooting of the targeted steady state scenarios. The analysis is organized around relatively short (5-year) time frames, so, from an ecological perspective, it is easy to see how this may be the case. A remaining point is that, when projected over very short timeframes, the steady state trajectory may not be dynamically stable over the long run. In other words, the estimates may not converge asymptotically simply because what they really register are short run adjustments toward a far-off equilibrium point that, anyhow, is known to be a perpetually moving target.

Turning to the second test, the dominant characteristic roots are used to calculate each system's *characteristic vector*, which describes the steady state trajectory itself. The transformed vectors that come out of this in the three time periods, consecutively, where the terms measure the comparative weight of changes in population density, employment density, and the average annual wage in the regional development process at the projected steady states, are: 0.25:0.52:0.23, 0.29:0.41:0.30, and 0.27:0.51:0.22 for Case 1; 0.23:0.53:0.24, 0.40:0.32:0.27, and 0.26:0.52:0.23 for Case 2; 0.26:0.52:0.23, 0.39:0.33:0.29, and 0.25:0.53:0.22 for Case 3; and 0.23:0.52:0.25, 0.36:0.34:0.30, and 0.24:0.52:0.24 for Case 4. Note that the various characteristic vectors all sum to one, so, to be clear, they describe the proportional magnitude of the three variables' influence on growth at equilibrium.

In each vector, the single largest component of the development process is employment, which is normally about twice the size of the other two, indicating an appropriate (fractionally reasonable) balance of people to jobs. The middle panel, covering the July 1990 – March 1991 recession, is clearly different from the other two, because the size of the employment effect shrinks and the size of the population and wage effects grow to where all three become basically equivalent. Put differently, compared to the first and third panels, the importance of employment is diminished in the second panel—a result that is probably symptomatic of how the adjustment process faltered during that period of economic contraction and correspondingly high unemployment. Looking beyond differences among the three time periods, differences associated with the specific mix of independent variables are really at the margin. On the one hand, from a purely empirical perspective, this is disappointing in the sense that the measures of human capital and quality of life factors are not observed to appreciably alter the trajectory of growth. On the other hand, from a more substantive theoretical perspective, it is highly encouraging because it indicates that the development process portrayed by the three-equation regional adjustment models is solid and, therefore, not very susceptible to wide swings that hinge on model specification.

6. Specific Research Questions

The introduction to this paper posed four specific research questions: How do demand- and supply-induced growth mechanisms impact the spatial pattern of development? Are human capital factors, which matter to firms, and quality of life factors, which matter to households, equally important? How has the adjustment process changed through time? And, finally, what are the implications for public policies aimed at shaping the outcome of development? The results of the empirical analysis yield direct answers to each.

First, returning to the difference between the two mechanisms of regional development: Demand-induced growth is precipitated by gains in the local export market but supply-induced growth is not, so, while both place pressure on the real estate market due to increased competition over space, only the former also leads to higher wages. Across the board—that being Tables 3 – 6—the spatial impacts of the alternative forms of growth are straightforward, consistent, and clear. Specifically, population density, a measure of the spatial intensity of labor supply, and employment density, a measure of the spatial intensity of labor demand, positively influence one another and, going in the same order, negatively and positively influence the average annual wage. Meanwhile, higher (lower) wages translate into lower population densities by causing households to consume more (less) land and higher (lower) employment densities by causing firms to consume less (more) land. In this way, the empirical models illustrate that the two interconnected drivers end up producing very different spatial outcomes via their impact on land consumption. Other things being equal, growth always translates into higher densities due to increased competition in the real estate market but, if wages also rise due to increased competition in the labor market, in pursuit of utility and profits, respectively, households will occupy more space and firms will occupy less space.

Second, on the question of how human capital and quality of life influence the equilibrating process, a tentatively encouraging finding is that, while both factors clearly matter, it appears that neither has to be made explicit in order for regional adjustment models to work properly. Even still, Case 4, containing the quality of life variables, is the only system that eventually passed a strict application of the test for dynamic stability, suggesting that its performance was, in fact, enhanced. Other research (for example, Partridge and Rickman 2003, 2006) demonstrates that the role of supply-induced growth, which is driven by personal preference rather than economic opportunity, has become progressively more powerful in recent years. If this is an accurate assessment—and, based on the results of this analysis, it certainly seems to be—it is not at all surprising that the quality of life factors emerged as the most important mediators of the adjustment process and that they did so fairly recently. The United States experienced a number of migration shifts in 1980s and 1990s that correspond, in large part, to the country’s business cycles and its industrial transition away from location-constrained manufacturing activities toward more footloose service activities. While recessionary periods tend to force people to follow jobs, the type of economic boom and restructuring that took place in the mid-1990s had just the opposite effect. All of that said, from an empirical standpoint, it is somewhat troubling that the mediating influence of the human capital factors was not observed to progress along the same kind of track but it may simply be that their effect is washed out by the overall inertia of the adjustment process.

Third, as explained at the onset, regional adjustment models emulate the space economy wobbling along a path of constant, interactive change as it searches for an optimal organization of labor demand, labor supply, and wages. Because of the way that economic opportunities and personal preferences change as time passes, this steady state is best thought of as a perpetually moving target, even though the underlying migration theory suggests that it may never actually be far from reach (Graves and Linneman 1979; Graves and Mueser 1993; Mueser and Graves 1995). The various characteristic vectors, which explicitly describe the equilibrium growth path that each of the models projects, validate this characterization. Taking any of the four cases as an example, moving away from the first panel, population and wages are observed to grow more important at the expense of employment during the recessionary middle panel before finding their way back to more-or-less their original magnitudes in the final panel. In short, on this question, the evidence suggests that the adjustment process fluctuates both rapidly and predictably through time and that it does so in a self-regulating way that is entirely consistent to the idea that the locational organization population, employment, and wages are inherently interdependent.

Fourth, the analysis has clear implications for public policies aimed at guiding the path of metropolitan development. Above all, it highlights the need for officials involved in developing so-called *growth control*, *growth management*, and/or *smart growth* frameworks better understand the nature of growth itself. All too often, the regulatory instruments—ranging from prosaic local zoning ordinances, to more sophisticated regional-scale urban growth boundaries, to very elaborate state-sponsored infrastructure concurrency requirements—intended to carry out these programs are designed in a virtual economic vacuum and little or no attention is given to the nature of what they are meant to alter. Given the substantive differences between the process and outcome of demand- versus supply-induced growth, it seems only logical that public policy should move to encourage what is desirable and discourage what is undesirable about the two mechanisms. A related point is that, if, as the evidence suggests, the development process is truly bidirectional, a great deal of regions' comparative advantage lies in their appeal as places to live in addition to their appeal as places to do business. Economic development policy has traditionally concentrated heavily on the latter by encouraging the creation of work, but regions must also invest in their future livability. Toward this end, public policy can be used to promote both dimensions of growth but, in order for it to do so, it must be closely attuned to specific circumstances and objectives (Mulligan et al. 2004; Carruthers and Mulligan 2006). Political realities dictate that the values of individual regions and the communities located within them are what determines the extent to which public policy works with or against the development process; how it responds to alternative land use patterns; and, ultimately, whether or not it adds to or takes away from the favored outcome/s. These are all normative issues for which there are no single answers but they need to be informed by theory and empirical observation. In the end, it is hoped that, by providing a closer view of the adjustment process, the present analysis takes positive steps toward helping policy makers frame the numerous and increasingly complex issues they confront in a way that leads to the best possible decisions.

7. Summary and Conclusion

This paper began with the premise that regional development happens in two interconnected ways: Via demand-induced growth, which is driven by economic opportunity, and supply-induced growth, which is driven by personal preference. The empirical analysis examined several questions regarding the nature of the relationship between these two mechanisms by estimating a series of three-equation regional adjustment models involving all metropolitan counties in the continental United States. The models yield substantive evidence that the growth process is bidirectional and indicate that the space economy has a self-regulating inertia of its own that keeps it in a state of constant flux as it searches for the optimal arrangement of activity. This state of spatial equilibrium is understood to be a perpetually moving target that evolves along with opportunities and preferences—but its high level of sensitivity to business cycles and other economic conditions over very short time periods suggests that it may never actually be far from reach. While it must be emphasized this analysis is mostly exploratory in nature, its findings are nonetheless important because they expose key differences in the spatial outcomes that the two growth mechanisms produce and pull back the veil, even if only slightly, on the very character of spatial equilibrium and how it shifts through time. Several closing thoughts on directions for future research follow from this brief summary.

To begin with, future work needs to further examine the actual balance of demand- and supply-induced growth mechanisms, including how it differs across regions, spatial frames of reference, and time periods. The analysis contained in this paper deliberately stops short of that because it does not capture a complete migration system, which involves moves from, to, and within nonmetropolitan areas in addition to metropolitan areas. A more complete analysis involving the entirety of a closed labor market is needed to develop an accurate assessment of this issue (Carruthers et al. 2006). Looking beyond regional adjustment models, a great deal of progress on the question of balance in the growth process is being made using relatively new time series techniques, such as cointegration (Yeo et al. 2005; Hunt 2006) and vector autoregression (Partridge and Rickman 2003, 2006). Spatial extensions of these approaches have recently become available (Fingleton 1999; Mur and Trívez 2003; Kosfeld and Lauridsen 2004; Lauridsen 2006) and there may be merit to exploring how to use these to analyze the dynamic relationship among population, employment, and wages. Yet another needed extension is to bring work done with regional adjustment models in line with more general models of regional convergence (Barro and Sala-i-Martin 1991, 1992, 2004). Many compelling spatial questions have emerged this area of study (see, for example, Fingleton 2003; Rey and Janikas 2005; Arbia 2006) and regional adjustment models, along with the compensating differentials foundation on which they rest, promise to make substantive contributions.

Last, on a more qualitative dimension of the development process, regional adjustment models are well positioned to address questions challenging the popular notion that equilibrium tendencies cause social welfare to converge across geographic space. Although this is often—and maybe correctly, but maybe not—accepted as an axiomatic point of departure in studies of regional development, certain evidence suggests that the reality may not be as simple as that. Specifically, following a more general national trend toward absolute income inequality over the last three decades, wages in American metropolitan areas have been found to exhibit growing spatial inequality as well (Drennan et al. 2004; Drennan 2005). With their highly empirical orientation and flexibility with respect to the kind of equilibrium and disequilibrium movements that characterize the space economy, regional adjustment models are powerful tools for studying such issues.

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Table 1. Definition and Source of Dependent and Independent Variables

	Definition:	Source:
Population Density	Ratio of population to acres of developed land	BEA, NRI
Employment Density	Ratio of employment to acres of developed land	BEA, NRI
Average Annual Wage	Ratio of total wages to population	BEA
Natural Amenity Score	Composite index of January temperature, January sunshine, July temperature, July humidity, topography, and water area (see McGranahan 1999)	ERS
Entertainment Establishments	Ratio of amusement, film, and museum establishments to population	CBP, BEA
Eating and Drinking Establishments	Ratio of eating and drinking establishments to population	CBP, BEA
Public Spending on Parks	Ratio of dollars to population	COG, BEA
% High School Educated	Ratio of high school educated population (no college) to population	CB
% College Educated	Ratio of college educated population to population	CB
Educational Institutions	Ratio of educational institutions to population	CBP, BEA
Spending on Education and Libraries	Ratio of dollars to population	
% Earnings in FIRE	Ratio of earnings in finance, insurance and real estate to total non-farm earnings	BEA
% Earnings in Manufacturing	Ratio of earnings in manufacturing to total non-farm earnings	BEA
% Earnings in Services	Ratio of earnings in services to total non-farm earnings	BEA
Total Population	Total number of people	BEA
Total Employment	Total number of jobs	BEA
Total Wages	Total volume of wages	BEA
Longitude	*x*-coordinate of county's geographic center	n/a
Latitude	*y*-coordinate of county's geographic center	n/a

Notes: All dollars are adjusted to 2005 values using the Bureau of Labor Statistics' CPI for all urban consumers; BEA denotes the Bureau of Economic Analysis; CB denotes the Census Bureau; CBP denotes County Business Patterns; COG denotes Census of Governments; ERS denotes the Economic Research Service; NRI denotes National Resources Inventory; and n/a denotes not applicable.

Table 2. Descriptive Statistics

	1982					1987					1992					1997				
	Mean:	Med.:	Max	Min.:	S.D.:	Mean:	Med.:	Max	Min.:	S.D.:	Mean:	Med.:	Max	Min.:	S.D.:	Mean:	Med.:	Max	Min.:	S.D.:
Population Density	1.00	0.84	14.60	0.14	0.84	1.00	0.82	15.77	0.15	0.89	1.00	0.82	16.24	0.15	0.90	1.00	0.81	17.89	0.16	0.96
$W \cdot$ Population Density	1.00	0.87	9.01	0.15	0.68	1.00	0.86	9.73	0.15	0.72	1.00	0.84	10.05	0.13	0.74	1.00	0.83	10.92	0/14	0.78
Employment Density	1.00	0.72	29.57	0.05	1.58	1.00	0.71	30.10	0.06	1.62	1.00	0.73	27.41	0.09	1.53	1.00	0.72	28.27	0.09	1.53
$W \cdot$ Employment Density	1.00	0.77	17.69	0.10	1.21	1.00	0.75	18.20	0.09	1.25	1.00	0.76	16.72	0.09	1.17	1.00	0.76	17.20	0.10	1.19
Average Annual Wage	1.00	1.00	1.77	0.52	0.18	1.00	0.98	1.75	0.58	0.17	1.00	0.98	1.73	0.60	0.19	1.00	0.97	1.89	0.61	0.19
$W \cdot$ Average Annual Wage	1.00	1.00	1.44	0.62	0.13	1.00	1.00	1.51	0.68	0.13	1.00	1.00	1.60	0.67	0.16	1.00	0.97	1.65	0.71	0.16
Natural Amenity Score	1.00	0.97	2.06	0.45	0.23	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Entertainment Establishments	1.00	0.99	3.95	0.00	0.44	1.00	0.96	4.36	0.00	0.46	1.00	0.97	3.51	0.00	0.36	n/a	n/a	n/a	n/a	n/a
Eating and Drinking Establishments	1.00	1.02	2.46	0.07	0.33	1.00	1.01	3.58	0.04	0.33	1.00	1.01	3.18	0.01	0.31	n/a	n/a	n/a	n/a	n/a
Spending on Parks	1.00	0.70	12.21	0.00	1.05	1.00	0.67	11.97	0.00	1.06	1.00	0.74	8.47	0.00	0.95	n/a	n/a	n/a	n/a	n/a
% High School Educated	1.00	1.02	1.30	0.60	0.13	1.00	1.01	1.35	0.61	0.11	1.00	1.01	1.42	0.60	0.10	n/a	n/a	n/a	n/a	n/a
% College Educated	1.00	0.91	3.17	0.22	0.44	1.00	0.92	3.01	0.26	0.44	1.00	0.92	2.87	0.27	0.43	n/a	n/a	n/a	n/a	n/a
Educational Institutions	1.00	0.91	4.17	0.00	0.69	1.00	0.97	4.19	0.00	0.62	1.00	0.95	3.63	0.00	0.58	n/a	n/a	n/a	n/a	n/a
Spending on Education and Libraries	1.00	0.94	24.87	0.07	0.87	1.00	0.97	2.13	0.05	0.25	1.00	0.96	2.09	0.15	0.26	n/a	n/a	n/a	n/a	n/a
% Earnings in FIRE	1.00	0.88	6.34	0.00	0.61	1.00	0.86	6.23	0.00	0.65	1.00	0.82	5.58	0.00	0.61	n/a	n/a	n/a	n/a	n/a
% Earnings in Manufacturing	1.00	0.93	3.00	0.00	0,56	1.00	0.93	3.07	0.00	0.58	1.00	0.91	3.52	0.00	0.59	n/a	n/a	n/a	n/a	n/a
% Earnings in Services	1.00	0.99	4.06	0.00	0.36	1.00	1.00	3.71	0.00	0.34	1.00	0.99	2.97	0.00	0.33	n/a	n/a	n/a	n/a	n/a
Total Population	1.00	0.46	35.76	0.02	9.92	1.00	0.44	37.24	0.02	2.24	1.00	0.45	36.94	0.02	2.19	n/a	n/a	n/a	n/a	n/a
Total Employment	1.00	0.38	39.23	0.01	2.52	1.00	0.37	39.34	0.01	2.44	1.00	0.39	35.46	0.01	2.27	n/a	n/a	n/a	n/a	n/a
Total Wages	1.00	0.31	44.29	0.02	2.76	1.00	0.30	45.92	0.003	2.74	1.00	0.32	41.47	0.002	2.59	n/a	n/a	n/a	n/a	n/a
Longitude	–88.40	–85.36	–68.65	–123.43	12.47	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Latitude	37.87	38.56	48.83	25.61	4.64	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes: All variables except for longitude and latitude are expressed as the ratio of the their local and national (1999 metropolitan) values; W is an 831 × 831 queen contiguity spatial weights matrix; n/a denotes not applicable.

Table 3a. S2SLS Estimates of Base Model, 1982 – 1987

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value:	Estimated Parameter:	*t*–value:	Estimated Parameter:	*t*–value:
Constant	–5.20E–02 ⋆⋆	–2.32	5.79E–04 n/s	0.01	1.39E–01 ⋆⋆⋆	9.04
Spatial Lag	7.00E–02 ⋆⋆⋆	8.78	–6.99E–02 ⋆⋆⋆	–8.74	2.17E–01 ⋆⋆⋆	10.75
Adjustment Variables						
ln (Population Density)	–2.83E–01 ⋆⋆⋆	–10.90	4.60E–01 ⋆⋆⋆	13.48	–1.45E–01 ⋆⋆⋆	–10.89
ln (Employment Density)	1.78E–01 ⋆⋆⋆	9.21	–3.53E–01 ⋆⋆⋆	–11.50	1.42E–01 ⋆⋆⋆	14.43
ln (Average Annual Wage)	–2.00E–01 ⋆⋆⋆	–6.52	5.24E–01 ⋆⋆⋆	8.04	–3.49E–01 ⋆⋆⋆	–28.29
Initial Size						
Total Size	1.67E–02 ⋆⋆⋆	10.70	–4.84E–03 n/s	–1.01	6.38E–03 ⋆⋆⋆	9.17
Total Size^2	–3.55E–04 ⋆⋆⋆	–8.56	6.29E–05 n/s	0.61	–1.33E–04 ⋆⋆⋆	–8.23
Location						
Central City	–2.29E–02 ⋆⋆⋆	–4.56	6.44E–02 ⋆⋆⋆	3.88	–3.18E–02 ⋆⋆⋆	–5.15
Longitude	–1.56E–03 ⋆⋆⋆	–18.07	7.99E–04 ⋆⋆⋆	3.80	9.52E–04 ⋆⋆⋆	7.02
Latitude	–1.85E–03 ⋆⋆⋆	–3.18	–7.55E–04 n/s	–0.63	–5.91E–04 n/s	–1.13
n		831		831		831
Adjusted R^2		0.33		0.27		0.38
λ_1						1.06
λ_2						0.85
λ_3						0.67

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ⋆⋆⋆ denotes significant at p < 0.01; ⋆⋆ denotes significant at p < 0.05; ⋆ denotes significant at p < 0.10; n/s denotes not significant.

Table 3b. S2SLS Estimates of Base Model, 1987 – 1992

	ln ($\dot{p}$)		ln ($\dot{e}$)		ln ($\dot{y}$)	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–1.93E–01 ★★★	–10.47	–3.19E–01 ★★★	–9.14	3.38E–02 ★★★	3.77
Spatial Lag	5.41E–02 ★★★	6.24	–2.91E–02 ★★	–2.42	1.02E–01 ★★★	5.11
Adjustment Variables						
ln (Population Density)	–1.89E–01 ★★★	–8.44	1.59E–01 ★★	2.42	–4.61E–03 n/s	–0.28
ln (Employment Density)	1.05E–01 ★★★	6.68	–1.60E–01 ★★★	–4.09	3.63E–02 ★★★	4.06
ln (Average Annual Wage)	–6.41E–02 ★★★	–2.77	1.55E–01 ★★★	4.78	–1.19E–01 ★★★	–5.05
Initial Size						
Total Size	1.15E–02 ★★★	5.70	–2.01E–03 n/s	–0.87	2.75E–03 ★★	1.99
Total Size^2	–2.40E–04 ★★★	–4.51	–2.29E–06 n/s	–0.04	–7.60E–05 ★★★	–2.95
Location						
Central City	–1.63E–02 ★★	–2.11	3.05E–02 ★★★	2.95	–1.80E–02 ★★★	–4.84
Longitude	–1.49E–03 ★★★	–15.30	–1.81E–03 ★★★	–7.99	2.57E–04 ★★★	3.41
Latitude	1.77E–03 ★★★	4.07	2.67E–03 ★★★	4.87	1.48E–04 n/s	0.56
n		831		831		831
Adjusted R^2		0.24		0.25		0.21
λ_1						0.98
λ_2						0.91
λ_3						0.82

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 3c. S2SLS Estimates of Base Model, 1992 – 1997

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–1.25E–01 ⋆⋆⋆	–4.08	–1.89E–01 ⋆⋆⋆	–5.95	–2.79E–02 ⋆	–1.88
Spatial Lag	6.42E–02 ⋆⋆⋆	7.23	–2.71E–02 n/s	–1.60	1.30E–01 ⋆⋆⋆	7.77
Adjustment Variables						
ln (Population Density)	–2.98E–01 ⋆⋆⋆	–16.39	2.12E–01 ⋆⋆⋆	5.97	–1.06E–01 ⋆⋆⋆	–9.67
ln (Employment Density)	2.03E–01 ⋆⋆⋆	8.99	–1.89E–01 ⋆⋆⋆	–8.90	8.26E–02 ⋆⋆⋆	7.56
ln (Average Annual Wage)	–1.81E–01 ⋆⋆⋆	–5.76	1.01E–01 ⋆⋆⋆	3.91	–1.76E–01 ⋆⋆⋆	–12.77
Initial Size						
Total Size	1.86E–02 ⋆⋆⋆	8.44	1.44E–02 ⋆⋆⋆	4.40	1.09E–02 ⋆⋆⋆	8.19
Total Size^2	–3.98E–04 ⋆⋆⋆	–6.52	–4.49E–04 ⋆⋆⋆	–4.74	–2.64E–04 ⋆⋆⋆	–7.71
Location						
Central City	–5.00E–02 ⋆⋆⋆	–4.82	1.87E–02 ⋆⋆⋆	2.91	–2.77E–02 ⋆⋆⋆	–5.13
Longitude	–1.91E–03 ⋆⋆⋆	–7.52	–9.82E–04 ⋆	–1.77	–3.61E–04 ⋆⋆⋆	–3.81
Latitude	–3.64E–04 n/s	–1.24	1.03E–03 n/s	1.37	2.26E–04 n/s	1.36
n		831		831		831
Adjusted R^2		0.32		0.19		0.10
λ_1						1.05
λ_2						0.85
λ_3						0.85

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ⋆⋆⋆ denotes significant at $p < 0.01$; ⋆⋆ denotes significant at $p < 0.05$; ⋆ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 4a. S2SLS Estimates of Industrial Model, 1982 – 1987

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–3.07E–02 n/s	–1.55	–1.98E–01 ★★★	–5.14	1.27E–01 ★★★	7.25
Spatial Lag	7.06E–02 ★★★	8.38	–1.87E–03 n/s	–0.19	2.14E–01 ★★★	11.80
Adjustment Variables						
ln (Population Density)	–2.71E–01 ★★★	–10.22	3.34E–01 ★★★	4.74	–1.34E–01 ★★★	–9.93
ln (Employment Density)	1.65E–01 ★★★	8.26	–2.91E–01 ★★★	–5.63	1.37E–01 ★★★	15.60
ln (Average Annual Wage)	–1.66E–01 ★★★	–5.12	1.97E–01 ★★★	2.69	–3.62E–01 ★★★	–22.17
Industrial Composition						
% Earnings in FIRE	4.15E–03 n/s	1.31	3.60E–02 ★★★	4.66	–4.81E–03 ★★	–2.08
% Earnings in Manufacturing	–1.71E–02 ★★	–2.01	–5.30E–03 n/s	–0.78	1.20E–02 ★	1.67
% Earnings in Services	–7.55E–03 n/s	–0.47	6.67E–02 ★★★	8.34	–3.67E–03 n/s	–0.38
Initial Size						
Total Size	1.51E–02 ★★★	12.40	4.62E–03 n/s	0.94	7.95E–03 ★★★	9.36
Total Size^2	–3.15E–04 ★★★	–9.23	–2.02E–04 ★★	–2.02	–1.68E–04 ★★★	–8.73
Location						
Central City	–1.92E–02 ★★★	–3.52	5.15E–02 ★★★	3.40	–2.98E–02 ★★★	–4.65
Longitude	–1.36E–03 ★★★	–11.28	1.37E–03 ★★★	6.02	7.76E–04 ★★★	4.40
Latitude	–1.48E–03 ★★	–1.97	3.54E–03 ★★★	4.09	–8.52E–04 n/s	–1.33
n		831		831		831
Adjusted R^2		0.34		0.24		0.40
λ_1						1.03
λ_2						0.86
λ_3						0.69

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 4b. S2SLS Estimates of Industrial Model, 1987 – 1992

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–2.15E–01 ★★★	–7.93	–3.79E–01 ★★★	–7.39	2.52E–02 ★★	2.00
Spatial Lag	5.09E–02 ★★★	5.68	–2.68E–02 ★★	–2.45	9.54E–02 ★★★	5.44
Adjustment Variables						
ln (Population Density)	–1.69E–01 ★★★	–6.70	1.59E–01 ★★★	2.66	1.86E–03 n/s	0.14
ln (Employment Density)	8.23E–02 ★★★	4.51	–1.67E–01 ★★★	–4.63	2.78E–02 ★★★	3.46
ln (Average Annual Wage)	–2.75E–02 n/s	–1.09	1.59E–01 ★★★	4.39	–1.03E–01 ★★★	–4.34
Industrial Composition						
% Earnings in FIRE	9.36E–03 ★★	2.42	2.23E–02 ★★★	2.65	5.43E–03 ★	1.74
% Earnings in Manufacturing	–8.07E–03 n/s	–1.05	1.04E–02 n/s	1.16	–2.93E–03 n/s	–0.86
% Earnings in Services	1.75E–02 n/s	1.54	3.36E–02 ★	1.82	2.85E–03 n/s	0.75
Initial Size						
Total Size	6.97E–03 ★★★	3.29	–8.69E–03 ★★★	–3.64	1.62E–03 n/s	1.22
Total Size^2	–1.34E–04 ★★	–2.24	1.37E–04 ★★	2.50	–5.48E–05 ★★	–2.12
Location						
Central City	–1.42E–02 ★★	–2.21	2.65E–02 ★★★	3.24	–1.72E–02 ★★★	–4.58
Longitude	–1.37E–03 ★★★	–12.33	–1.79E–03 ★★★	–7.59	3.21E–04 ★★★	4.54
Latitude	2.10E–03 ★★★	4.73	2.72E–03 ★★★	5.33	3.52E–04 n/s	1.48
n		831		831		831
Adjusted R^2		0.25		0.27		0.21
λ_1						1.00
λ_2						0.91
λ_3						0.82

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 4c. S2SLS Estimates of Industrial Model, 1992 – 1997

	ln ($\dot{p}$)		ln ($\dot{e}$)		ln ($\dot{y}$)	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–1.64E–01 ***	–4.25	–2.98E–01 ***	–5.20	–5.26E–02 ***	–2.83
Spatial Lag	5.95E–02 ***	7.59	–1.77E–02 n/s	–0.91	1.26E–01 ***	8.37
Adjustment Variables						
ln (Population Density)	–2.77E–01 ***	–16.64	1.54E–01 ***	2.64	–9.55E–02 ***	–12.75
ln (Employment Density)	1.82E–01 ***	8.22	–1.58E–01 ***	–5.05	7.52E–02 ***	9.10
ln (Average Annual Wage)	–1.60E–01 ***	–4.29	6.35E–02 **	2.09	–1.81E–01 ***	–11.76
Industrial Composition						
% Earnings in FIRE	5.49E–03 n/s	0.96	3.30E–02 ***	8.32	1.22E–02 ***	3.95
% Earnings in Manufacturing	1.88E–03 n/s	0.32	1.11E–02 **	2.22	1.19E–02 **	2.03
% Earnings in Services	2.49E–02 n/s	1.43	5.38E–02 **	1.67	–3.85E–03 n/s	–0.45
Initial Size						
Total Size	1.59E–02 ***	5.15	7.40E–03 ***	2.62	9.72E–03 ***	9.27
Total Size^2	–3.33E–04 ***	–3.70	–2.75E–04 ***	–3.94	–2.50E–04 ***	–8.86
Location						
Central City	–4.83E–02 ***	–5.44	6.49E–03 n/s	1.32	–2.68E–02 ***	–5.85
Longitude	–1.92E–03 ***	–8.84	–1.31E–03 **	–2.17	–4.87E–04 ***	–6.82
Latitude	–2.93E–04 n/s	–0.96	9.50E–04 n/s	1.26	4.25E–05 n/s	0.21
n		831		831		831
Adjusted R^2		0.34		0.20		0.14
λ_1						1.02
λ_2						0.85
λ_3						0.85

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; *** denotes significant at $p < 0.01$; ** denotes significant at $p < 0.05$; * denotes significant at $p < 0.10$; n/s denotes not significant.

Table 5a. S2SLS Estimates of Human Capital Model, 1982 – 1987

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–7.78E–02 ★★★	–3.52	–2.31E–01 ★★★	–4.87	1.28E–01 ★★★	5.54
Spatial Lag	7.33E–02 ★★★	8.17	–3.67E–03 n/s	–0.38	2.09E–01 ★★★	11.57
Adjustment Variables						
ln (Population Density)	–2.71E–01 ★★★	–10.15	3.36E–01 ★★★	4.90	–1.25E–01 ★★★	–8.06
ln (Employment Density)	1.69E–01 ★★★	7.99	–2.96E–01 ★★★	–5.65	1.29E–01 ★★★	13.55
ln (Average Annual Wage)	–1.98E–01 ★★★	–6.60	1.87E–01 ★★	2.13	–3.63E–01 ★★★	–26.81
Human Capital						
% High School Educated	1.49E–01 ★★★	6.01	6.47E–02 n/s	1.36	4.94E–04 n/s	0.03
% College Educated	7.70E–03 n/s	0.87	4.14E–03 n/s	0.65	–5.32E–03 n/s	–1.38
Educational Institutions	–1.01E–02 ★★	–2.38	1.94E–02 ★★	2.03	2.61E–03 n/s	0.76
Public Spending on Education and Libraries	3.21E–03 ★★★	5.96	–9.54E–03 ★	–1.91	5.71E–03 ★★★	7.86
Industrial Composition						
% Earnings in FIRE	5.22E–03 n/s	1.41	3.20E–02 ★★★	3.97	–4.56E–03 ★★★	–2.68
% Earnings in Manufacturing	–1.49E–02 ★	–1.73	–2.05E–03 n/s	–0.25	1.26E–02 ★	1.70
% Earnings in Services	–6.28E–03 n/s	–0.37	5.95E–02 ★★★	5.22	–4.00E–03 n/s	–0.50
Initial Size						
Total Size	1.61E–02 ★★★	9.91	4.60E–03 n/s	0.91	7.84E–03 ★★★	9.40
Total Size^2	–3.27E–04 ★★★	–7.10	–1.91E–04 ★	–1.88	–1.66E–04 ★★★	–9.00
Location						
Central City	–1.73E–02 ★★★	–3.18	5.06E–02 ★★★	3.32	–2.89E–02 ★★★	–4.70
Longitude	–8.93E–04 ★★★	–4.39	1.33E–03 ★★★	3.51	7.86E–04 ★★★	4.28
Latitude	–3.22E–03 ★★★	–5.25	2.39E–03 ★★★	2.76	–1.01E–03 n/s	–1.35
n		831		831		831
Adjusted R^2		0.36		0.24		0.40
λ_1						1.07
λ_2						0.84
λ_3						0.68

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 5b. S2SLS Estimates of Human Capital Model, 1987 – 1992

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–2.64E–01 ★★★	–8.12	–3.83E–01 ★★★	–6.28	3.18E–02 ★	1.75
Spatial Lag	5.22E–02 ★★★	6.32	–2.72E–02 ★	–1.91	7.10E–02 ★★★	4.67
Adjustment Variables						
ln (Population Density)	–1.72E–01 ★★★	–7.24	1.55E–01 ★★	2.09	2.38E–02 ★	1.90
ln (Employment Density)	8.94E–02 ★★★	4.70	–1.71E–01 ★★★	–3.92	6.46E–03 n/s	0.75
ln (Average Annual Wage)	–4.94E–02 ★	–1.92	1.64E–01 ★★★	3.53	–8.15E–02 ★★★	–3.01
Human Capital						
% High School Educated	7.12E–02 ★	1.71	–8.95E–03 n/s	–0.25	–5.78E–02 ★★★	–3.02
% College Educated	8.59E–03 ★★	2.16	8.73E–03 n/s	1.17	2.88E–03 n/s	0.83
Educational Institutions	–2.33E–03 n/s	–0.49	1.76E–02 ★★	2.25	7.20E–03 ★	1.93
Public Spending on Education and Libraries	2.35E–02 ★★	2.42	–2.21E–02 ★	–1.94	1.38E–02 ★★★	3.47
Industrial Composition						
% Earnings in FIRE	1.05E–02 ★★★	2.86	1.96E–02 ★★★	2.78	5.62E–03 ★	1.86
% Earnings in Manufacturing	–6.00E–03 n/s	–0.76	1.05E–02 n/s	1.13	–1.86E–03 n/s	–0.45
% Earnings in Services	1.83E–02 ★	1.78	2.66E–02 n/s	1.54	2.48E–03 n/s	0.57
Initial Size						
Total Size	6.95E–03 ★★★	3.36	–7.93E–03 ★★★	–3.28	9.06E–04 n/s	0.71
Total Size^2	–1.30E–04 ★★	–2.29	1.28E–04 ★★	2.34	–4.25E–05 ★	–1.74
Location						
Central City	–1.55E–02 ★★	–2.46	2.59E–02 ★★★	3.44	–1.50E–02 ★★★	–3.99
Longitude	–1.20E–03 ★★★	–7.96	–1.93E–03 ★★★	–6.27	2.66E–04 ★★★	5.53
Latitude	1.08E–03 ★★	2.01	2.81E–03 ★★★	4.98	8.15E–04 ★★★	2.98
n		831		831		831
Adjusted R^2		0.26		0.28		0.21
λ_1						0.99
λ_2						0.91
λ_3						0.83

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 5c. S2SLS Estimates of Human Capital Model, 1992 – 1997

	ln ($\dot{p}$)		ln ($\dot{e}$)		ln ($\dot{y}$)	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–1.76E–01 ⋆⋆⋆	–6.03	–3.35E–01 ⋆⋆⋆	–6.03	–9.92E–03 n/s	–0.68
Spatial Lag	5.89E–02 ⋆⋆⋆	7.51	–1.20E–02 n/s	–0.62	1.17E–01 ⋆⋆⋆	7.91
Adjustment Variables						
ln (Population Density)	–2.76E–01 ⋆⋆⋆	–14.46	1.40E–01 ⋆⋆	2.34	–7.96E–02 ⋆⋆⋆	–8.63
ln (Employment Density)	1.86E–01 ⋆⋆⋆	7.19	–1.57E–01 ⋆⋆⋆	–5.05	6.12E–02 ⋆⋆⋆	6.10
ln (Average Annual Wage)	–1.48E–01 ⋆⋆⋆	–3.88	5.78E–02 ⋆⋆⋆	3.08	–1.61E–01 ⋆⋆⋆	–9.62
Human Capital						
% High School Educated	2.76E–02 n/s	1.00	7.08E–02 ⋆	1.93	–6.73E–02 ⋆⋆⋆	–4.80
% College Educated	–2.21E–03 n/s	–0.54	–6.33E–03 n/s	–0.79	2.70E–03 n/s	0.85
Educational Institutions	–1.76E–02 ⋆⋆⋆	–4.65	2.85E–02 ⋆⋆	2.28	–5.42E–03 n/s	–1.21
Public Spending on Education and Libraries	1.20E–02 n/s	1.39	–2.51E–02 ⋆⋆⋆	–1.95	–1.02E–02 n/s	–1.26
Industrial Composition						
% Earnings in FIRE	8.94E–03 n/s	1.62	2.91E–02 ⋆⋆⋆	10.29	1.30E–02 ⋆⋆⋆	5.08
% Earnings in Manufacturing	1.07E–03 n/s	0.18	1.08E–02 ⋆⋆	2.27	1.10E–02 ⋆	1.89
% Earnings in Services	3.25E–02 ⋆⋆	2.06	4.52E–02 n/s	1.28	–3.01E–03 n/s	–0.31
Initial Size						
Total Size	1.45E–02 ⋆⋆⋆	5.12	8.54E–03 ⋆⋆⋆	3.44	8.85E–03 ⋆⋆⋆	8.56
Total Size^2	–3.03E–04 ⋆⋆⋆	–3.69	–2.81E–04 ⋆⋆⋆	–4.49	–2.37E–04 ⋆⋆⋆	–9.08
Location						
Central City	–4.72E–02 ⋆⋆⋆	–4.79	6.81E–03 n/s	1.35	–2.37E–02 ⋆⋆⋆	–4.96
Longitude	–1.86E–03 ⋆⋆⋆	–7.70	–1.36E–03 ⋆⋆	–2.42	–4.97E–04 ⋆⋆⋆	–6.48
Latitude	–5.49E–04 n/s	–1.22	3.11E–04 n/s	0.35	9.19E–04 ⋆⋆⋆	3.09
n		831		831		831
Adjusted R^2		0.34		0.21		0.17
λ_1						1.02
λ_2						0.86
λ_3						0.86

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ⋆⋆⋆ denotes significant at $p < 0.01$; ⋆⋆ denotes significant at $p < 0.05$; ⋆ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 6a. S2SLS Estimates of Quality of Life Model, 1982 – 1987

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–8.92E–02 ***	–4.02	–2.29E–01 ***	–4.58	2.82E–02 **	2.11
Spatial Lag	5.99E–02 ***	8.32	9.83E–03 n/s	0.85	1.79E–01 ***	8.92
Adjustment Variables						
ln (Population Density)	–2.40E–01 ***	–9.93	2.60E–01 ***	4.17	–1.37E–01 ***	–11.10
ln (Employment Density)	1.36E–01 ***	7.50	–2.52E–01 ***	–5.22	1.26E–01 ***	17.53
ln (Average Annual Wage)	–1.05E–01 ***	–3.39	1.36E–01 **	2.29	–3.14E–01 ***	–22.79
Quality of Life						
Natural Amenity Index	4.59E–02 ***	4.56	4.04E–02 **	2.39	8.53E–02 ***	14.74
Entertainment Establishments	–1.86E–02 n/s	–1.21	4.19E–02 ***	3.45	1.33E–04 n/s	0.02
Eating and Drinking Establishments	–1.46E–02 n/s	–1.46	1.84E–02 n/s	0.67	–6.41E–02 ***	–4.97
Public Spending on Parks and Recreation	–9.71E–03 **	–2.09	5.35E–03 n/s	1.49	4.41E–04 n/s	0.20
Industrial Composition						
% Earnings in FIRE	1.26E–02 ***	3.20	3.13E–02 ***	3.76	4.80E–03 ***	3.63
% Earnings in Manufacturing	–1.82E–02 **	–2.17	–5.01E–03 n/s	–0.63	1.36E–02 *	1.80
% Earnings in Services	6.07E–03 n/s	0.35	3.80E–02 ***	3.35	5.83E–03 n/s	0.68
Initial Size						
Total Size	1.42E–02 ***	9.98	9.23E–03 **	2.31	8.03E–03 ***	5.29
Total Size^2	–2.99E–04 ***	–7.16	–3.09E–04 ***	–3.73	–1.87E–04 ***	–4.84
Location						
Central City	–6.46E–03 n/s	–1.09	3.85E–02 ***	3.34	–1.67E–02 **	–2.35
Longitude	–9.58E–04 ***	–4.63	1.65E–03 ***	5.26	1.60E–03 ***	22.76
Latitude	7.13E–05 n/s	0.10	3.24E–03 **	2.21	2.28E–03 ***	3.40
n		831		831		831
Adjusted R^2		0.35		0.27		0.49
λ_1						1.04
λ_2						0.85
λ_3						0.69

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; *** denotes significant at p < 0.01; ** denotes significant at p < 0.05; * denotes significant at p < 0.10; n/s denotes not significant.

Table 6b. S2SLS Estimates of Quality of Life Model, 1987 – 1992

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value	Estimated Parameter:	*t*–value
Constant	–2.29E–01 ★★★	–7.90	–2.15E–01 ★★★	–4.60	–8.99E–03 n/s	–0.49
Spatial Lag	4.97E–02 ★★★	6.25	–1.24E–02 n/s	–1.36	9.92E–02 ★★★	6.26
Adjustment Variables						
ln (Population Density)	–1.59E–01 ★★★	–6.30	1.67E–01 ★★★	3.10	–3.18E–02 ★★★	–3.03
ln (Employment Density)	7.14E–02 ★★★	3.32	–1.78E–01 ★★★	–5.04	5.37E–02 ★★★	7.00
ln (Average Annual Wage)	–1.72E–02 n/s	–0.71	1.54E–01 ★★★	4.44	–1.23E–01 ★★★	–7.44
Quality of Life						
Natural Amenity Index	6.34E–03 n/s	0.25	–1.74E–01 ★★★	–15.47	4.22E–02 ★★★	5.77
Entertainment Establishments	–1.29E–02 ★★	–2.00	1.51E–02 ★★	2.45	5.80E–03 n/s	1.61
Eating and Drinking Establishments	9.38E–04 n/s	0.07	3.40E–02 ★	1.75	–2.81E–02 ★★★	–3.97
Public Spending on Parks and Recreation	1.71E–03 n/s	0.70	1.22E–02 ★★★	4.73	–1.68E–03 n/s	–1.23
Industrial Composition						
% Earnings in FIRE	1.23E–02 ★★★	4.08	1.33E–02 n/s	1.41	6.80E–03 ★★★	2.56
% Earnings in Manufacturing	–7.69E–03 n/s	–1.05	6.12E–03 n/s	0.56	–2.16E–03 n/s	–0.79
% Earnings in Services	2.18E–02 ★★	2.16	2.85E–02 n/s	1.48	2.29E–03 n/s	0.51
Initial Size						
Total Size	5.38E–03 ★★	2.07	–7.31E–03 ★★★	–2.84	2.14E–03 ★	1.88
Total Size^2	–8.29E–05 n/s	–1.15	1.36E–04 ★★	2.26	–7.57E–05 ★★★	–3.17
Location						
Central City	–1.00E–02 n/s	–1.31	2.83E–02 ★★★	3.96	–1.85E–02 ★★★	–6.09
Longitude	–1.23E–03 ★★★	–4.15	–3.22E–03 ★★★	–13.53	6.00E–04 ★★★	6.32
Latitude	2.61E–03 ★★	2.56	–1.52E–03 ★★	–2.04	1.48E–03 ★★★	4.13
n		831		831		831
Adjusted R^2		0.24		0.35		0.27
λ_1						1.02
λ_2						0.89
λ_3						0.80

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

Table 6c. S2SLS Estimates of Quality of Life Model, 1992 – 1997

	$\ln(\dot{p})$		$\ln(\dot{e})$		$\ln(\dot{y})$	
	Estimated Parameter:	*t*–value:	Estimated Parameter:	*t*–value:	Estimated Parameter:	*t*–value:
Constant	–1.80E–01 ★★★	–4.14	–1.56E–01 ★★★	–3.34	–3.66E–02 ★★	–2.27
Spatial Lag	5.48E–02 ★★★	6.87	–1.74E–02 n/s	–0.85	1.14E–01 ★★★	9.17
Adjustment Variables						
ln (Population Density)	–2.56E–01 ★★★	–14.70	2.57E–01 ★★★	3.40	–8.07E–02 ★★★	–4.97
ln (Employment Density)	1.64E–01 ★★★	8.41	–2.38E–01 ★★★	–5.22	7.03E–02 ★★★	4.11
ln (Average Annual Wage)	–1.48E–01 ★★★	–4.39	8.92E–02 ★★★	2.73	–1.69E–01 ★★★	–10.41
Quality of Life						
Natural Amenity Index	8.32E–03 n/s	0.74	–1.52E–01 ★★★	–12.14	–1.65E–02 ★★	–2.03
Entertainment Establishments	–9.51E–03 n/s	–1.21	5.65E–02 ★★★	3.07	1.29E–02 ★	1.85
Eating and Drinking Establishments	–3.23E–02 ★★★	–2.89	4.28E–02 n/s	1.46	–4.37E–02 ★★★	–6.77
Public Spending on Parks and Recreation	3.37E–03 ★	1.87	1.75E–02 ★★★	4.87	–1.59E–03 n/s	–1.08
Industrial Composition						
% Earnings in FIRE	1.01E–02 ★★	2.02	2.00E–02 ★★★	4.66	1.36E–02 ★★★	4.45
% Earnings in Manufacturing	2.67E–03 n/s	0.52	1.17E–02 ★★	1.98	1.04E–02 ★	1.76
% Earnings in Services	3.42E–02 ★★	2.02	3.67E–02 n/s	0.88	1.88E–03 n/s	0.21
Initial Size						
Total Size	1.35E–02 ★★★	4.09	7.65E–03 ★★★	2.91	9.00E–03 ★★★	7.98
Total Size^2	–2.78E–04 ★★★	–2.88	–2.89E–04 ★★★	–3.52	–2.53E–04 ★★★	–7.42
Location						
Central City	–3.84E–02 ★★★	–5.01	1.45E–02 ★★	2.03	–1.98E–02 ★★★	–3.80
Longitude	–1.77E–03 ★★★	–10.16	–2.22E–03 ★★★	–4.34	–5.97E–04 ★★★	–5.82
Latitude	7.48E–04 n/s	1.29	–3.59E–03 ★★★	–5.98	4.51E–04 ★★	2.01
n	831		831		831	
Adjusted R^2		0.35		0.28		0.19
λ_1						0.98
λ_2						0.89
λ_3						0.84

Notes: All equations were estimated using White-adjusted standard errors clustered by metropolitan area; all hypothesis tests are two-tailed; ★★★ denotes significant at $p < 0.01$; ★★ denotes significant at $p < 0.05$; ★ denotes significant at $p < 0.10$; n/s denotes not significant.

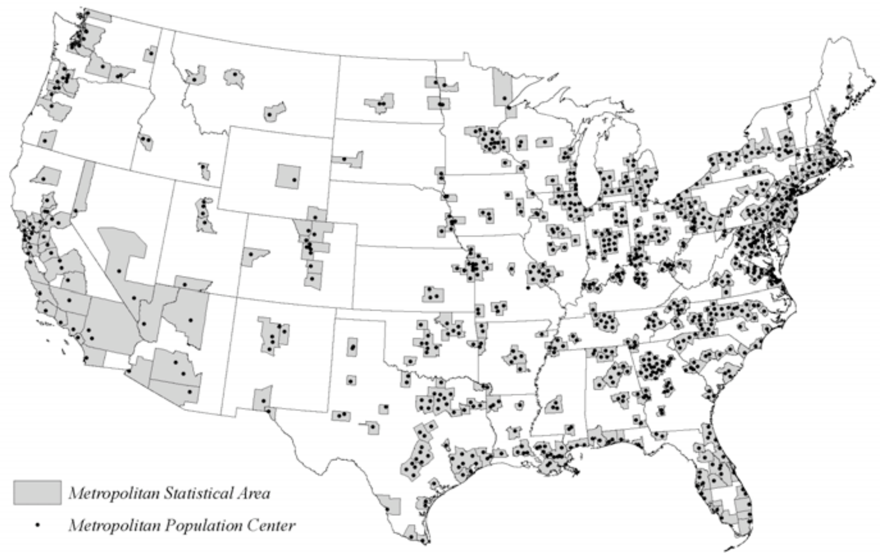

Figure 1. American Metropolitan Areas

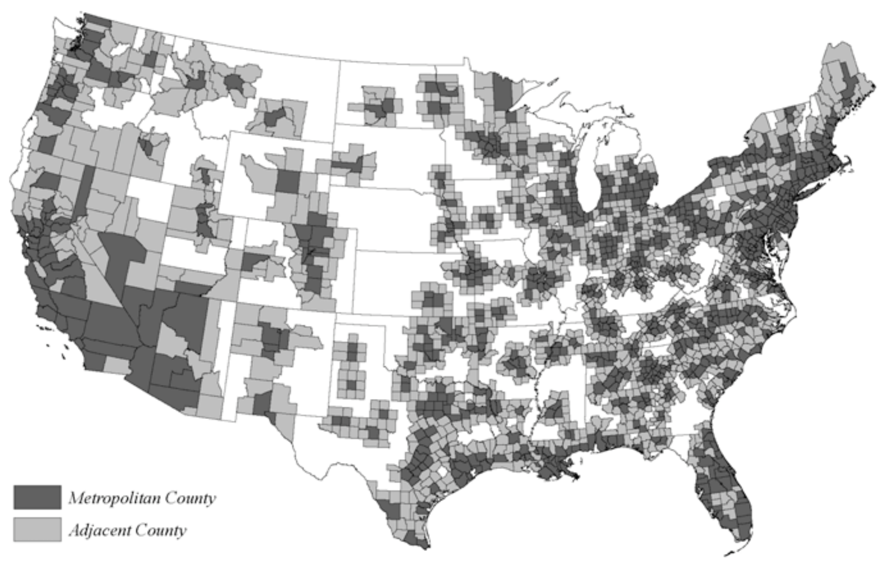

Figure 2. Metropolitan and Adjacent Nonmetropolitan Counties