Talent-Laden Population Dynamics, Spillovers and Economic Impacts: Implications to Population and Talent Attraction Strategies

Yohannes G. Hailu and Majd Abdulla[1]

Abstract: This study evaluates the drivers of cohort-level talent-laden population dynamics. By utilizing national data on metro and non-metro counties, and employing system of equations modeling, key similarities and differences in factors that determine population dynamics are identified. In a second stage analysis, the implications of cohort-level population dynamics to economic development are evaluated, with a focus on employment and per capita income growth. Results suggest that the young age group is the most spatially mobile in both metro and non-metro counties; home values and affordable homes matter to middle-age cohorts; agglomeration of talent appeals to the young, while existence of knowledge infrastructure is relevant in urban settings; taxes, relative to services, matter in both metro and non-metro environments, though metro residents are more sensitive to it; amenities and quality of life matter, but there are significant differences between metro and non-metro responses, and the preference of each age cohort; and that there are significant regional differences in the ability to attract and retain cohort-level population. With regard to economic development, while the attraction of population seems to be across-the-board beneficial in both metro and non-metro economies, attraction of the young are particularly more effective in employment growth, followed by retirees. Income growth, however, seems to be less sensitive to population dynamics. Four policy implications are relevant: (1) even though population and talent attraction strategies in both settings can be leveraged and harmonized, there are unique differences between the two; (2) the marginal effectiveness of policies that rely on one tool, vis-à-vis others, will need to be carefully evaluated; (3) since different age cohorts respond in varying manner to key drivers, a homogenous population attraction strategy that doesn't differential by age cohorts is less likely to have the desired effect; (4) utilization of certain population attraction strategies involve trade-offs and crowding-out effects. These countervailing forces and unintended reactions will need to be evaluated to design efficient talent and population attraction strategies.

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Introduction

The thinking of policy makers, community leaders, academicians and the general public is converging towards the common understanding that the structure of the U.S. economy has undergone structural changes, from what some have called the "old economy" to the "new economy." [2] Similar to past structural transformations, such as the industrial revolution, this period is revealing an increased degree of migration of the general population, and particularly talented and knowledge workers, to communities that can effectively engage them (Barro and Sala-i-Martin, 1995; Glaeser, et al. 2000; Clark, 2003; Florida, 2002a). Unlike past structural transformations, the emerging "new economy" is particularly characterized by the predominance of information and telecommunication technologies, globalization and enhanced mobility of knowledge workers and capital that has redefined communities and places across the United States. Recent advances in endogenous growth models recognize these shifts by demonstrating the increased relevance of such "new economy" assets as human capital (Lucas, 2002), knowledge workers (Mathur, 1999; McGranahan and Wojan, 2007), talent (Glaeser and Saiz, 2004; Florida, 2002a), knowledge infrastructure (Etzkowitz, et al., 2000; Glaeser and Saiz, 2003), innovation (Blakely, 1994) and entrepreneurs (Hackler, 2003) to economic development. The migration of cohort-level population is also shown to have a systemic impact on economic development (Whisler, et al., 2008; Chen and Rosenthal, 2008).

Historically, the economic development community has commonly emphasized two categories of strategies for local and regional economic development – fiscal incentives (tax-based competition) and infrastructure development. Three types of fiscal instruments are common: (1) fiscal incentives, such as lower interest rates, grants and loan guarantees; (2) tax reductions, including tax credits, abatements, deductions and preferential rates; and (3) direct grants, including land, labor and infrastructure (see Fisher, 1997). Reliance on these tools is consistent with the notion that cost of doing business is a prime determinant of business location choice (Easterly and Sergio, 1993; Wu, 2005; Mofidi and Stone, 1990; Phillips and Gross, 1995; Bartik, 1991; Fry, 1995). There is growing evidence that these strategies are less effective today. For instance, Sands and Reese (2007) demonstrated the ineffectiveness of tax-abatement-type strategies in Michigan. Expenditure on

[2] Coined in the late 1990s, the term "New Economy" refers to the impact of information and communications technology (IT) on the economy. It may imply that places that provide for greater capacity to integrate technology into products and services can perform better, compared to traditional manufacturing locations which created value through the basic manufacturing process. Innovative and talented people, entrepreneurs, and other knowledge workers are more valuable in the New Economy.

public infrastructure is another strategy to improve growth prospects (Aschauer, 1989; Evans and Karras, 1994; Wylie, 1996). Johnson (1990) and Graham (1999), however, suggest that investment in infrastructure is a necessary condition, but not a sufficient condition for growth.

Recent studies highlight the relevance of the geography of talent and population agglomerate to community economic performance in the "new economy." For instance, the concentration of entrepreneurs and knowledge workers are related to economic development (King and Levine, 1993; Levine, 1997; Montgomery and Wascher, 1988; Rousseau and Wachtel, 1998; Abrams, et al., 1999). Similarly, Wu (2005) highlighted the role of venture capital, which accentuates technological differences among communities. The mobility of these drivers across the landscape from places that lack, or lose, the required precursors to anchor these valuable assets to new places that have emerged as competitive is a central theme of economic development in the "new economy."

The development of human capital, and the geographic concentration of talent, enhances productivity, and hence economic growth (Lucas, 2002; Glaeser and Saiz, 2004; Rangazas, 2005; Benhabib and Speigel, 1994; Barro, 1997). There is also growing evidence that innovation affects economic growth (Romer, 1990; Mokyr, 1990), particularly in metro areas (Glaeser, 2005; Mathur, 1999). There is increasing evidence that these assets are also vital to rural economic development (Beyers and Lindahl, 1996; McGranahan and Wojan, 2007).

More recent works focus on the relevance of the creative class in economic development. Clark (2003) and Florida (2002a), for instance, suggest that urban amenities are catalysts in attracting knowledge workers, thereby spurring economic development; and the mobility of the creative class has profound effect on growth performance than inter-place cost differentials (Florida, 2005). Eaton and Eckstein (1997) and Black and Henderson (1998) further suggested that productivity is enhanced when workers co-located, and when sufficient cluster is created, it becomes an incentive for the attraction of knowledge firms (Glaeser, et al. 2000). Though the bulk of studies focus on urban settings, McGranahan and Wojan (2007) attempted to establish similar findings in rural settings.

Science-based evidence on the role of talent, the creative class, innovation, entrepreneurs and venture capitalists in economic development have spurred numerous innovative policies centered around the attraction and retention of these "new economy" assets. Mathur (1999) and McGranahan and Wojan (2007), for instance, argue that attracting and retaining knowledge workers boosts employment and income performance. The reason for these effects can be found in Bauer, et al. (2006): (1) knowledge workers are more productive; (2) education and technology enable the expansion of high productivity jobs (see also Rangazas, 2005); (3) education and technology enable better absorption of economic shocks; (4) education and technology enhance creativity (see also Glaeser and Saiz, 2004); and (5) education and technology greater inter-place exchange of ideas and

innovation (see also Benhabib and Speigel, 1994; Barro, 1997). Similarly, Simon (1998) and Glendon (1998) found a positive relationship between the average level of human capital and employment growth, suggesting that attraction and retention of knowledge workers can be an effective strategy.

Even though there is increasing consensus about the role of knowledge workers in economic development, the migration of general population cohorts is also tied to community economic performance. The dynamics of talent-laden general population has been an important determinant of the nature and pace of economic development in urban and rural communities, including income growth (Marcouiller et al., 2004; Brueckner et al., 1999; Hunter et al., 2005). Economic opportunities have been related to the young and middle age population cohort migration (Greenwood and Hunt, 1989; Clark and Hunter, 1992). Population cohorts may migrate for different reasons: the young for employment opportunities and quality business environment (Kodrzyski, 2001); and retirees for high-amenity and quality places (Chen and Rosenthal, 2008; Clark et al., 1996; Heaton et al., 1981; Bennett, 1996; Judson, 1999; Shields et al., 2001), though they are not as concerned with the job climate as they are with cost of living constraints (Heaton et al., 1981). Based on the understanding that retirees are likely to generate more revenue than costs for local units of government (Shields et al., 2001), their migration has been targeted as a population-centered economic development strategy. The attraction of the young and talented is also tied to the attraction of high-tech industries (Florida, 2000), which in turn can lead to employment growth (McGranahan and Wojan, 2007). Dorfman et al. (2008), for instance, found that having an additional 1% of college graduates would result in 53 additional high-tech jobs. These types of results have motivated the impetus for attracting and retaining young professionals and immigrants (Florida, 2002).

Population-centered economic development strategies have focused on quality of life as a way of promoting attractiveness of communities to high-tech firms (Dorfman et al., 2008), retirees (Duncombe et al., 2000), young professionals (Florida, 2002), and businesses (Gottlieb, 1994). However, disparities are likely to continue across communities based on their ability to attract and retain talent and population, which are mainly related to quality of life factors (Glaeser et al., 2001).

The discussion thus far on the role of attracting and retaining knowledge workers and population has numerous implications, particularly to underserved and declining communities. First, the mobility of population, knowledge workers and capital from historically manufacturing-based prosperous places to new places has drastically affected socioeconomic performance in declining places. These communities feature rising unemployment, rising poverty, declining property values, urban and rural blight, and population and talent drain (Glaeser and Gyourko, 2005). Second, the relative structural fixity of economies in under-served communities and minimal transition to the “new economy” has limited economic competitiveness in these communities

(Adelaja, et al., 2009). Third, the excessive reliance of economic development agencies, state organizations and the economic development community in utilizing traditional economic development tools (such as tax-based competition) (Fisher, 1997), partly due to limited available knowledge about "new economy" economic development, has hampered strategic policy implementation. For places that are struggling to find their share of prosperity in the "new economy," these implications have profound long-term economic impacts.

As communities experience shifts in their economic wellbeing, perhaps due to the loss of valuable assets (such as talent, knowledge workers and population at large) to other prosperous communities, they are increasingly raising numerous economic development questions, particularly in underserved and declining communities: (1) what are the sources of economic development and prosperity in the "new economy"? (2) in the face of significant loss in population and human capital, what strategies can be implemented to mitigate, and reverse, the tide of such out-migration? (3) is there evidence that population and talent attraction strategies enhance economic development in the "new economy"? (4) what strategies are available in leveraging local and regional assets in attracting talent and population to strengthen local and regional economies? (5) are there differences in urban and rural strategies for population and talent attraction? Are there different returns to such investment? These, and similar questions, are at the center of discussions about emerging innovative economic development strategies.

Though past studies are informative in exploring some of these practical issues, there are numerous gaps in the literature that limit comprehensive answers to some of these questions. First, the literature focuses on specific economic development issues that may not provide a comprehensive analysis and insights. This may inhibit policy makers and the economic development community in making efficient decisions about the marginal returns on investment in population and talent attraction strategies, vis-à-vis other alternatives. Second, in the context of the "new economy," there is a general lack of empirical evidence (McGranahan and Wojan, 2007), particularly about the relative importance of population and talent attraction strategies, vis-à-vis other traditional strategies. Third, there is limited work in terms of population and talent attraction and retention strategies that compare urban and rural communities. It is likely that urban and rural strategies of economic development, that center on talent and population attraction, to be partly different. The predominant focus of prior studies on urban settings is particularly limiting to policy makers and the economic development community that are primarily interested in rural and underserved communities. The current study aims to close many of these gaps.

The main objectives of this study are, therefore: (1) to provide a comprehensive analysis about the roles of knowledge workers and cohort-level population attraction and retention in

economic development; (2) to demonstration the impact of knowledge-laden cohort population migration on economic performance of communities in urban and rural settings; (3) to provide evidence on what drives cohort-level population migration that would inform population and talent attraction strategies; (4) to demonstrate the spatial spillover effects of economic development and knowledge assets to inform inter-governmental cooperation in the "new economy"; and (5) to address key policy questions, discussed above, that are relevant to economic development practitioners, particularly in rural, underserved or declining places.

Why Population Matters, Especially to Underserved and Declining Places?

The literature on the impact of population out-migration focuses on national and international scales. International migration studies show that migrants tend to be young skilled workers seeking higher rates of return from work (Haque and Kim, 1995). These migrants impose tax impacts in their host countries that make financing such public services as education, healthcare and pension systems more challenging (Longman, 2004; Kuroda, 1996; Childress, 2001). This pressure forces governments to tax workers at higher rates (Kurtz, 2005; Weil, 2006), further incentivizing human capital loss through emigration (Haque and Kim, 1995).

At the local and regional levels, out-migration also imposes numerous impacts on people-exporting communities (Hummel and Lux, 2007). The decline in productive labor force affects aggregate production (Chapple, 2004; Longman, 2004; Reher, 2008), since most migrants tend to be young and active (Schweiker, 2008). If out-migration is significant, and precipitous, it generates demand shocks that would impact aggregate outputs, and hence employment levels (Muhleisen and Faruqee, 2001). For example, Glaeser and Gyourko (2005) show that cities experiencing greater decline tend to have lower levels of human capital with accompanying poor living standards. These communities also feature declining property values (Mulder, 2006; Stillman and Mare, 2008). For instance, Terrones and Otrok (2004) estimated that a 1% increase in population is associated with a 4% gain in real estate values, suggesting that population loss erodes property values. These impacts on aggregate demand and property values have significant effects on local public finance (Kurtz, 2005; Weil, 2006), increasing the vulnerability of local governments to fiscal disequilibrium that may make providing such public services as education, road maintenance, snow removal, public safety, parks and other outdoor recreational opportunities more difficult within the existing tax and expenditure structure, directly impacting quality of life.

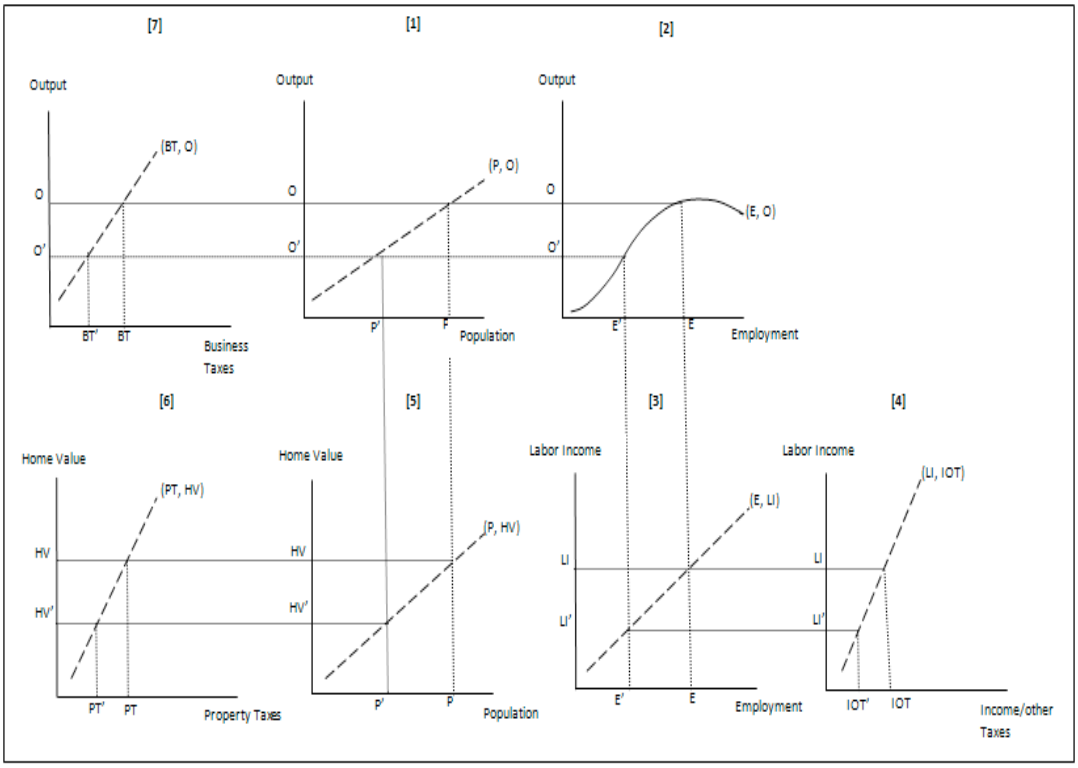
In those underserved and shrinking places where population and human capital loss has been precipitous, local and regional governments have introduced such policy responses as raising taxes, "right-sizing" declining places, employment and income security policies, affordable housing policies, consolidating public services across jurisdictions, establishing land banks to deal with

blight, and other forms of inter-governmental collaboration to deal with economic shrinkage (Zoubanov, 2000; Pyl, 2009; Rybczynski and Linneman, 1999; Shilling and Logan, 2008). In these places, talent and population attraction and retention policies have become even more crucial.

Consider the example of communities in Michigan and Ohio that faced rapid population decline. In the 2000-2005 time periods, 43% of Ohio counties and 37% of Michigan counties lost population. In the subsequent four years from 2005, county population losses accelerated to inflict 76% of Michigan counties and 52% of Ohio counties. Not only were the percentages of counties losing population, but the actual magnitudes grew large. For instance, Cuyahoga County, Ohio hosts the City of Cleveland. From 2000-2005, the county lost 70,000 people, with additional 48,000 in the next four years since 2005. Similarly, Wayne County, Michigan, which hosts the City of Detroit, lost 36,000 people from 2000-2005, and an additional 99,000 people in the subsequent four years.

The local economy impacts of such rapid population loss can be traced through Figure 1. Population loss reduces aggregate output (panel 1), which would impact employment levels (panel 2), labor income (panel 3) and income taxes (panel 4). Output reduction can also reduce tax collections from businesses (panel 7). Population decline will also have implications to the housing market, through its impact on home values (panel 5) and property tax collection (panel 6).

Figure 1: The Impact of Population Loss on Local Economies – Graphical Depiction.



In the case of communities that are rapidly losing population in Michigan and Ohio, the authors have estimated the economic impacts, through IMPLAN analysis. In the case of Ohio communities that lost population in the 2005-2009 periods, the economic impacts were losses of over $7 billion in labor income, over 213,000 jobs and $31 billion in economic output; as well as losses of more than $709 million in federal taxes and more than $654 million in state and local taxes. Similarly, the losses in Michigan, for the same time period, in communities that lost population were over $4.8 billion in labor income, over 142,000 jobs, and over $21 billion in lost economic output; as well as over $1 billion in federal taxes and over $1 billion in state and local taxes (Adelaja, Hailu and Abdulla, 2009). The authors also conducted analysis to determine the geographic and sectoral distribution of these impacts. The economic burden of population loss is mainly concentrated in underserved and declining places, though they tend to be predominantly urban. The sectoral distribution of economic impacts shows that the economic impacts are mainly concentrated in the service sector, which poses serious economic challenges in these communities in the long-run, as the service sector is a growing part of the economy in terms of employment generation.

From the preceding discussion and demonstration of case studies in Michigan and Ohio, it is clear than population and human capital loss have a broad range of impacts to local economic development, ranging from fiscal impacts, economic output, employment, labor income and property value losses. These effects can erode the ability of communities to position themselves to new economic development and prosperity. As such, population attraction and retention has become central to emerging economic development strategies in the "new economy."

Why talent, knowledge workers, innovation and knowledge infrastructure matter?

Recent literature highlights the roles of knowledge workers, innovation and knowledge infrastructure as key sources of place competitiveness and economic development. The transition of the U.S. economy towards knowledge-dependent activities has intensified competition for talent (Levin, 1997; Rousseau and Wachtel, 1998; Clark, 2003; Florida, 2002a). Places that succeed in attracting and retaining knowledge workers have a unique advantage in attracting knowledge-dependent firms (Glaeser, et al., 2000), enhancing ability of regional economies to create more jobs (Simon, 1998; Glendon, 1998). The attraction of the creative class is also tied to metropolitan competitiveness (Florida, 2000; Scott, 2000), and more recent studies are discovering similar positive effects in rural economies (McGranahan and Wojan, 2007).

Innovation and creativity, which are related to talent agglomeration, are also critical elements of the knowledge economy. Places that enhance creativity and innovation have better economic growth performance (Glaeser, 2005; Florida and Gates, 2001). Universities, colleges and research institutions are part of the knowledge infrastructure that accentuates inter-place

differences in innovation (Etzkowitz, et al., 2000). The presence of such infrastructure is an essential element of "new economy" development (Wu, 2005; Glaeser and Saiz, 2003). Furthermore, places where innovation takes place, specialized research is undertaken and scientists and industry collaborate on creating new products serve as incubators for new firms (Abdullateef, 2000; Mayer, 2003).

To explore the relative role of these growth drivers, vis-à-vis other factors, the authors conducted a separate analysis on the role of knowledge workers, innovation and knowledge infrastructure on employment and income growth in urban and rural communities.[3] For instance, a 1% increase in the young population cohort is associated with 2,851 more jobs in urban economies; 1% more educated population is associated with 53 additional jobs in urban economies, and 25 in rural economies; the presence of colleges and universities is associated with 1,336 new jobs in urban economies; a 1% increase in creative class employment has a $35 enhancement in per capita income in rural economies, and a 23 additional jobs effect in urban economies; and that innovation is productive in that rural income grows by $3.60/patent, compared to $3.27 in urban areas, while the employment growth effect is 494/patent generated in urban economies, and just 4.4/patent in rural areas. Clearly, these results, based on nationwide urban and rural counties analysis for the 1990-2000 time periods, suggest that knowledge workers, innovation and knowledge infrastructure are critical to economic development in the "new economy."

As a result, a number of European countries and the U.S. are engaged in brain competition policy (Reiner, 2010). Similarly, regions and local jurisdictions in Canada are engaged in similar efforts (Lepawsky, et al., 2010). By designing talent attraction policies through promotion of quality places to live, Scotland is also engaged in similar talent attraction efforts to enhance economic performance (Pollock, 2006). There is also evidence that firms are competing to attract and retain talented workers to enhance their productivity in Australia (Holland, et al, 2007). In the U.S., the economic geography implications of talent distribution are highlighted by Florida (2002b), who found a relationship between talent agglomeration and economic development. In the case of China, Qian (2010) found that the geographic distribution of talent in China is related to innovation, entrepreneurship and regional economic performance. Therefore, from state to regional and local levels, talent attraction and retention has become an active economic development tool.

The implications to underserved and declining places are clear. First, emergence of new places that compete for talent, entrepreneurs and innovators means that the competition for these assets has intensified, and places that outsource such critical assets will be at a significant disadvantage in the "new economy." Second, investment in attracting and retaining these assets has

[3] For a broader discussion about theoretical framework, empirical model and detailed analysis on this subject, see Adelaja, Hailu and Abdulla, "Sources of Growth in the New Economy", forthcoming in the *International Journal of Regional Science*.

become an important economic development strategy. Third, the cycle of economic decline imposes risks to regional economies as valuable human capital tends to out-migrate to prosperous places, thus reinforcing the cycle of decline. Fourth, once regional economies become less competitive in creating new knowledge-based industries, their prospects for expanding high-paying jobs and healthy and competitive regional economies diminishes. It is, therefore, critical to ask what drives the mobility of knowledge workers and population cohorts across regions, to leverage appropriate strategies for economic development. This issue, as discussed earlier, is the main focus of this study.

Drivers of Cohort-level Population Dynamics and Economic Impacts: Theoretical Framework

To lay the proper framework for empirical examination of the drivers of cohort-level population dynamics and its economic development implications, a simple theoretical model on the location choice problem of people and firms is presented. The main goal of this section is to consider two key factor in location choice – quality of life and economic opportunities of places – and demonstrate how these factors determine the mobility of talent and population from one community to another. In reality, location choice problem is much more complex, and will involve many more factors than quality of life and economic conditions. The empirical analysis will deal with these complexities. In this section, a simple framework and discussion is provided.

Location Choice of Households

Much of the literature suggests that amenities and quality of life factors are important determinants of a person's location choice (Foster, 1977; Bartik, 1985; McGranahan, 1999; Deller et al., 2001; Marcouiller et al., 2004). It is, therefore, assumed that individuals maximize their welfare by optimally choosing locations. These locations may provide access to high-quality amenities, and employment and income opportunities. Therefore, households choose locations (communities) given their endowment of amenities (Z_1) and public goods (Z_2) that constitute place quality, and employment (E) opportunities ($E\mu$). Location choice is subject to an income (Y) constraint.

Utility from Z_1 and Z_2 depends on the accessibility of amenities (γ) and public goods (α). Employment opportunities in a place are influenced by Z_1 and Z_2, as quality places are likely to attract employment opportunities (Gottlieb, 1994). It is also assumed that places have different cost-of-living environment as reflected in local wages (w) that is considered vis-à-vis employment opportunities. Households choose either to stay in their current location (J), or move to all potential locations (i), depending on the relative endowment of amenities and employment opportunities between location J and all other locations, i.

Let Q = private goods and services (a *numeraire*); Z_1 = amenities endowment; $Z_{1i} - Z_{1J}$ = the difference in amenities endowment between location J and all other potential locations, i; Z_2 = public goods; $Z_{2i} - Z_{2J}$ = the difference in amenity services between location J and all other potential locations; P_{z1} = the tax price of Z_1; $P_{Z_1 i} - P_{Z_1 J}$ = the difference in tax price of natural amenity services between household's current location J and all other potential locations; P_{z2} = the tax price of Z_2; $P_{Z_2 i} - P_{Z_2 J}$ = the difference in tax price of public good services between the current location and all other potential locations; $(E_i(\mu) - E_J(\mu)$ = the expected likelihood of job opportunities in locations i compared to location J; $w_i(Z_1, Z_2, E_{\mu_i}) - w_J(Z_1, Z_2, E_{\mu_J})$ = the wage differences between location i and location J; Y_J = disposable income (including current wage); γ = degree of accessibility of amenities (0 = no access, 1 = open access); and α = degree of accessibility of public goods (0 = no access, 1=open access). Let $\tilde{Z}_1 = \gamma_i Z_{1i} - \gamma_J Z_{1J}; \tilde{Z}_2 = \alpha_i Z_{2i} - \alpha_J Z_{2J}; \tilde{P}_{Z_1} = P_{Z_1 i} - P_{Z_1 J}; \tilde{P}_{Z_2} = P_{Z_2 i} - P_{Z_2 J}; \tilde{E} = (E_{\mu_i}(\gamma,\alpha) - E_{\mu J}(\gamma,\alpha)); \tilde{w} = w_i - w_J$, where γ and α are measures of the degree of accessibility of amenities and public goods.

Then, the objective function can be specified as:

$$MaxU[Q, Y_J - \tilde{w} - \tilde{P}_{Z_1}.\tilde{Z}_{1i} - \tilde{P}_{Z_2}.\tilde{Z}_{2i},\ \tilde{Z}_{1i}, \tilde{Z}_{2i}, \tilde{E}_\mu] \tag{1}$$

Individuals maximize utility by optimally considering $\tilde{Z}_{1i}$, $\tilde{Z}_{2i}$ and $\tilde{E}_\mu$ across locations. The conditions for optimization are:

$$U_{\tilde{Z}_1} + U_{\tilde{E}_\mu}.\tilde{E}_{\mu\tilde{Z}_1} = \tilde{P}_{Z_1} + [U_{\tilde{w}}.\tilde{w}_{\tilde{E}_\mu}.\tilde{E}_{\mu\tilde{Z}_1} + U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_1}] \tag{2}$$

$$U_{\tilde{Z}_2} + U_{\tilde{E}_\mu}.\tilde{E}_{\mu\tilde{Z}_2} = \tilde{P}_{Z_2} + [U_{\tilde{w}}.\tilde{w}_{\tilde{E}_\mu}.\tilde{E}_{\mu\tilde{Z}_2} + U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_2}] \tag{3}$$

$$U_{\tilde{w}}.\tilde{w}_{\tilde{E}_\mu} = U_{\tilde{E}_\mu} \tag{4}$$

The relationships in (2), (3) and (4) characterize a spatial equilibrium. That is, optimal location choice would occur when the marginal change in utility from natural amenity services and employment enhancement between current location and potential moving locations equals the marginal tax share differentials and the net wage effect of amenities (from 2); the marginal utility from public goods and their job enhancement effect between current location and potential moving locations equals the change in the marginal tax share differentials and the net wage effect of public goods (from 3); and the marginal utility from differential employment opportunities equals the wage differential (from 4). These conditions define the decision to move or not, and to which location(s) to move.

The choice of location by individuals given $\tilde{Z}_{1i}$, $\tilde{Z}_{2i}$ and $\tilde{E}_{\mu}$ are, however, controlled by accessibility. With respect to access to amenities, the optimal location choice given degree of accessibility is:

$$(1-\tilde{P}_{Z_1})[U_{\tilde{Z}_1}.\tilde{Z}_{1\gamma}] = U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_1}.\tilde{Z}_{1\gamma}. \tag{5}$$

The optimality condition in (5) suggests that access to amenities can enhance utility if $\partial U / \partial \tilde{Z}_1 > 0$, and that at equilibrium, the utility enhancing effect of access to amenities is equal to the downward wage effects (Nosal and Rupert, 2003).

Note that the marginal utility of access to natural amenities is weighted by $(1-\tilde{P}_{Z_1})$. As $\tilde{P}_{Z_1}$ increases (i.e., the tax share differential), the utility associated with access to amenities declines. When $\tilde{P}_{Z_1}$ equals 0, there is no tax advantage, and the community that households move to provides the same tax share on $\tilde{Z}_1$ as their current community. In this case, the utility associated with enhanced access to amenities increases. Furthermore, as $\tilde{P}_{Z_1}$ becomes negative (i.e., the community households move to provides lower tax share on $\tilde{Z}_1$ than current community), the utility associated with access to amenities substantially increases.

It is important to note that the weighting factor $(1-\tilde{P}_{Z_1})$ can play a crucial role, given access to amenities. From (5), let $U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_1}.\tilde{Z}_{1\gamma} = A$, and $U_{\tilde{Z}_1}.\tilde{Z}_{1\gamma} = B$. Then, given access to amenities, it follows that:

$$\left\{\begin{array}{lll} A=(1-\tilde{P}_{Z_1})B & \Rightarrow & Optimal\,location\,choice\,given\,\gamma \\ If\ \tilde{P}_{Z_1}\in(0,1)\,and\,\tilde{P}_{Z_1}\uparrow \Rightarrow A>(1-\tilde{P}_{Z_1})B & \Rightarrow & Location J\,becomes\,attractive\,given\,\gamma \\ If\ \tilde{P}_{Z_1}=0 & \Rightarrow A=B & \Rightarrow Location\,choice\,indifference \\ If\ \tilde{P}_{Z_1}<0 & \Rightarrow A<<(1-\tilde{P}_{Z_1})B & \Rightarrow Location J\,becomes\,muchless\,attractive\,given\,\gamma \end{array}\right\} \tag{6}$$

The effect of access to public goods can similarly be shown by differentiating the mover's utility function with respect to this access. It then follows that:

$$(1-\tilde{P}_{Z_2})[U_{\tilde{Z}_2}.\tilde{Z}_{2\alpha}] = U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_2}.\tilde{Z}_{2\alpha}. \tag{7}$$

Let $U_{\tilde{w}}.\tilde{w}_{\tilde{Z}_2}.\tilde{Z}_{2\alpha} = A$, and $U_{\tilde{Z}_2}.\tilde{Z}_{2\alpha} = B$. Then, it follows that:

$$\left\{\begin{array}{lll} A=(1-\tilde{P}_{Z_2})B & \Rightarrow & \textit{Optimal location choice given } \alpha \\ \textit{If } \tilde{P}_{Z_2}\in(0,1) \textit{ and } \tilde{P}_{Z_2}\uparrow \Rightarrow A>(1-\tilde{P}_{Z_2})B & \Rightarrow & \textit{Location J becomes attractive given } \alpha \\ \textit{If } \tilde{P}_{Z_2}=0 \Rightarrow A=B & \Rightarrow & \textit{Location indifference.} \\ \textit{If } \tilde{P}_{Z_2}<0 \Rightarrow A<<(1-\tilde{P}_{Z_2})B & \Rightarrow & \textit{Location J becomes much less attractive given } \alpha \end{array}\right\} \quad (8)$$

In this framework, though the location preference, and hence migration, of different age cohorts could be different, we provide a basic framework for the evaluation of roles of quality of life and economic opportunities on population migration. Age cohort-related differences are discussed elaborately in the empirical section.

Location Choice of Businesses

Now consider the location choice of businesses. Service-dependent firms are particularly tied to population migration. It is assumed that businesses locate where they do in order to maximize profit, and if any other location provides a better return, they are assumed to be flexible, at least in the long-run, to take advantage of location-based differences in profits. Population centers may feature concentration of talent and high-quality labor that can enhance productivity and profitability of businesses. Therefore, where population and talent move, businesses are likely to adjust in the long-run due to the underlying changes in their bottom-line.

Following the preceding discussions, let Z_1 and Z_2 mean location-specific amenities and public goods. Since firms are motivated by profit maximization, a place's endowment of natural amenities and ability to provide quality public services will have to affect the revenue base or cost structure to be a relevant decision factor. This can be possible through: (1) population growth enhances demand for services, and hence increases revenue; (2) concentration of talent in a given area enhances profitability through productivity gains. Note that to the extent that population itself is driven by economic conditions, quality of amenities and public services, businesses will implicitly consider these parameters.

A simple profit maximization framework that explicitly considers quality of life can be specified as:

$$Max\pi = pf(T(Z_1,Z_2),x\,|\,\phi)-cx-w(Z_1,Z_2)T(Z_1,Z_2) \quad (9)$$

where π is the profit equation, p is the price of the service, f is the production function, ϕ is all other factors that affect revenue, c is the per unit cost of inputs (x),and w is the wage rage for productive labor input (T). Note that both wage and concentration of productive labor are affected by amenities. This is because households trade between high wage and high amenities. There is a trade-off between high quality places and wages. Similarly, productive labor force concentration is

tied to amenities since households, given options and ability, will choose high quality environments. The maximization with respect to x and T is:

$$pf'x = c; \quad pf'T = w. \tag{10}$$

With respect to the amenity factors, Z_1 and Z_2, the optimal firm location choice, given the distribution of amenities and public services, is:

$$pf_{TZ_1} - Tw_{z_1} = wT_{Z_1}$$

$$pf_{TZ_2} - Tw_{z_2} = wT_{Z_2} \tag{11}$$

Equation 10 implies that the marginal productivity value of talent agglomerated by amenities, and the employment of quality labor at relatively lower wages compensated by amenities is compared against the marginal cost of quality labor supply, enhanced by amenities. In general, as one moves from urban to rural communities, concentration of quality labor diminishes. However, amenities often increase at increasingly lower wages. These factors are optimally weighted to assess the best location for businesses. Similarly, equation (11) implies that the marginal productivity value of talent agglomerated by quality public services, and the availability of talent at relatively lower wages compensated by quality public services is weighed against the marginal cost of quality labor, agglomerated by quality public services. Now consider the sensitivity of profit to the distribution of quality of life. The profit function is given as:

$$Max\,\pi^* = pf(T(Z_1^*, Z_2^*), x \mid \phi) - cx - w(Z_1^*, Z_2^*)T(Z_1^*, Z_2^*) \tag{12}$$

Totally differentiating equation (12) yields:

$$d\pi^* = p\left[f_{TZ_1}dZ_1 + f_{TZ_2}dZ_2 + f_x dx\right] + \sum_i f_{\phi_i} d\phi_i + f(.)dp - cdx - xcd - T\left[w_{Z_1}dZ_1 + w_{Z_2}dZ_2\right] - w\left[T_{Z_1}dZ_1 + T_{Z_2}dZ_2\right] \tag{13}$$

Holding all else constant, the effect of amenities on business profitability is evaluated as follows:

$$\frac{d\pi^*}{dZ_1} = p\left[f_{TZ_1}dZ_1\right] - T\left[w_{Z_1}dZ_1\right] - w\left[T_{Z_1}dZ_1\right]. \tag{14}$$

Note that the sign of $d\pi^*/dZ_1$ is indeterminate. $p\left[f_{TZ_1}dZ_1\right] > 0$, since high quality places are attractive to quality labor, whose employment enhances productivity and profitability; $T\left[w_{Z_1}dZ_1\right] > 0$, i.e., high amenity areas compensate lower wages; and $w\left[T_{Z_1}dZ_1\right] < 0$, i.e., concentration of quality labor, in quality places, increases the average wage rate in the labor market, hence puts downward pressure on profitability. If the first two effects dominate, then the overall effect of amenities on

profitability is positive. Otherwise, it is an empirical issue that can be resolved by empirical evidence.

Holding all else constant, the effect of public services on business profitability is evaluated as follows:

$$\frac{d\pi^*}{dZ_2} = p\left[f_{TZ_2} dZ_1\right] - T\left[w_{Z_2} dZ_2\right] - w\left[T_{Z_2} dZ_2\right]. \tag{15}$$

Note that the sign of $d\pi^*/dZ_2$ is also uncertain. Similar arguments apply to each component of equation (15).

In the above demonstrated simple framework, the indirect effect of quality of life on location choice of firms is presented. In combination with consumer side analysis, note that while amenities have a direct effect on where households want to live, they have an indirect effect on business location choice through cost and revenue structure effects. The analysis can be expanded to evaluate more complex location choice problems.

Empirical Model: Talent-Laden Population Dynamics and Economic Development

To inform talent and population attraction and retention strategies, it is important to understand the determinants of cohort-level population dynamics. These drivers can inform effective strategies in urban and rural settings. We have selected the following age cohorts for empirical analysis: the 18-21 year olds (mostly in college), the 22-24 year olds (fresh out of college, potentially with contemporary knowledge), the 25-34 year olds (initial career establishment), the 35-54 year olds (settlement and family establishment), the 55-64 year olds (pre-retirement group), and the 65+ year olds (mostly retirees). Recent studies have shown that the young possess valuable talent and contemporary knowledge (Florida, 2000), while retirees are increasingly entrepreneurial (Singh and DeNoble, 2003). To evaluate the dynamics of these age cohorts, a system of equations model is given as:

$$\begin{aligned}
P_{18-21}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O) \\
P_{22-24}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O) \\
P_{25-34}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O) \\
P_{35-54}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O) \\
P_{55-64}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O) \\
P_{65+}{}^* &= f(E^*, Y^*, \Gamma^a, \Omega^O)
\end{aligned} \tag{16}$$

where $P_{18\text{-}21}$*, $P_{22\text{-}24}$*, $P_{25\text{-}34}$*, $P_{35\text{-}54}$*, $P_{55\text{-}64}$* and P_{65+}* are equilibrium levels of each of these age groups in a place (such as a county); E* and Y* are equilibrium levels of employment and per capita income in a place; Γ^a is a vector for quality of life attributes; and Ω^O is a vector for all other exogenous factors in the system. Since this work aims to explain both the determinants of cohort-level population dynamics and the economic development impacts, we further proxy economic development indicators in a community through changes in employment and per capita income. These economic dynamics can be modeled as:

$$\begin{aligned} Y^* &= f(E^*, P_{18-21}{}^*, P_{22-24}{}^*, P_{25-34}{}^*, P_{35-54}{}^*, P_{55-64}{}^*, P_{65+}{}^*, \Gamma^a, \Omega^O) \\ E^* &= f(Y^*, P_{18-21}{}^*, P_{22-24}{}^*, P_{25-34}{}^*, P_{35-54}{}^*, P_{55-64}{}^*, P_{65+}{}^*, \Gamma^a, \Omega^O). \end{aligned} \tag{17}$$

Population groups, employment and income growth in a place adjust from their lagged values. Population and employment are likely to adjust to their equilibrium values (Mills and Price 1984). Similarly, income will also adjust to its equilibrium value with substantial lags. The distributed lag adjustment equations for cohort population dynamics and economic impacts can be given together as a system as:

$$\begin{aligned} P_{18-21_t} &= P_{18-21_{t-1}} + \lambda_{p18-21}(P_{18-21}{}^* - P_{18-21_{t-1}}) \\ &\quad . \\ &\quad . \\ &\quad . \\ P_{65+_t} &= P_{65+_{t-1}} + \lambda_{P65+}(P_{65+}{}^* - P_{65+_{t-1}}) \\ Y_t &= Y_{t-1} + \lambda_y(Y^* - Y_{t-1}) \\ E_t &= E_{t-1} + \lambda_e(E^* - E_{t-1}) \end{aligned} \tag{18}$$

where $\lambda_{P18-21}, \ldots, \lambda_{P65+}, \lambda_E$ and λ_Y are speed-of-adjustment coefficients that take values between zero and one, and $t-1$ is one period time lag. The speed-of-adjustment value measures how fast growth happens between the previous period and the current period.

Current cohort population, employment and income levels can be expressed as initial level values plus the changes between the initial and current time periods. Using Δ to denote change, equation (18) can be expressed as:

$$
\begin{aligned}
\Delta P_{18-21} &= \lambda_{p_{18-21}}(P_{18-21}{}^{*} - P_{1821_{t-1}}) \\
&\quad . \\
&\quad . \\
&\quad . \\
\Delta P_{65+} &= \lambda_{p_{65+}}(P_{65+}{}^{*} - P_{65+_{t-1}}) \\
\Delta Y &= \lambda_{y}(Y^{*} - Y_{t-1}) \\
\Delta E &= \lambda_{e}(E^{*} - E_{t-1})
\end{aligned}
\tag{19}
$$

In equation (19), the equilibrium levels of employment, income and cohort-level population are not known. Utilizing equations (18) and (19), the equilibrium values can be identified as:

$$
\begin{aligned}
\Delta P_{18\text{-}21} &= \lambda_{P8\text{-}21}.f_{p18\text{-}21}\{(Y_{t-1}+\lambda_Y\Delta Y)+(E_{t-1}+\lambda_E\Delta E)\}-\lambda_{p18\text{-}21}P_{18\text{-}21_{t-1}}+\sum\varpi_i\Gamma^{a}{}_{P_{18\text{-}21_i}}+\sum\sigma_i\Omega^{O}_{P_{18\text{-}21_I}}+\psi_i \\
&\quad . \\
&\quad . \\
&\quad . \\
\Delta P_{65+} &= \lambda_{p65+}.f_{p65+}\{(Y_{t-1}+\lambda_Y\Delta Y)+(E_{t-1}+\lambda_E\Delta E)\}-\lambda_{p65+}P_{65+_{t-1}}+\sum\psi_i\Gamma^{a}{}_{P65+_i}+\sum\gamma_i\Omega^{O}_{P65+_I}+\eta_i \\
\Delta Y &= \lambda_Y.f_y\{(E_{t-1}+\lambda_E\Delta E)+(P_{Y_{t-1}}+\lambda_{Py}\Delta P_Y)+(P_{R_{t-1}}+\lambda_{pR}\Delta P_R)\}-\lambda_Y Y_{t-1}+\sum\vartheta_i\Gamma^{a}{}_{y_i}+\sum\beta_i\Omega^{O}_{Y_I}+\varepsilon_i \\
\Delta E &= \lambda_E.f_e\{(Y_{t-1}+\lambda_Y\Delta Y)+(P_{Y_{t-1}}+\lambda_{Py}\Delta P_Y)+(P_{R_{t-1}}+\lambda_{PR}\Delta P_R)\}-\lambda_E E_{t-1}+\sum\delta_i\Gamma^{a}{}_{E_i}+\sum\alpha_i\Omega^{O}_{E_I}+\varphi_i
\end{aligned}
\tag{20}
$$

where the Ω variables represent all exogenous variables in each equation, and $\psi_i,...,\eta_i,\varepsilon_i$ and φ_i are error terms associated with estimating each equation. The speed-of-adjustment coefficients (λ_i) are embedded in the linear coefficient parameters of α,β and γ in the econometric model. Thus, the joint talent-laden population dynamics and economic development impacts models can jointly be given as an econometric system of equations as:

$$
\begin{aligned}
\Delta P_{18-21} &= \sigma_0+\sigma_1 Y_{t-1}+\sigma_2 E_{t-1}+\sigma_3\Delta Y+\sigma_4\Delta E+\sum_{i=10}^{k}\varpi_i\Gamma^{a}_{P_{18-21I}}+\sum_{i=k+1}^{n}\sigma_i\Omega^{O}_{P_{18-21}}+\psi_i \\
&\quad . \\
&\quad . \\
&\quad . \\
\Delta P_{65+} &= \gamma_0+\gamma_1 Y_{t-1}+\gamma_2 E_{t-1}+\gamma_3\Delta Y+\gamma_4\Delta E+\sum_{i=10}^{k}\psi_i\Gamma^{a}_{P_{165+I}}+\sum_{i=k+1}^{n}\gamma_i\Omega^{O}_{P_{65+I}}+\eta_i \\
\Delta Y &= \beta_0+\beta_1 E_{t-1}+\beta_2 P_{t-1}+\beta_3\Delta E+\beta_4\Delta P_{18-21}+...+\beta_9\Delta P_{65+}+\sum_{i=10}^{k}\vartheta_i\Gamma^{a}_{Y_I}+\sum_{i=k+1}^{n}\beta_i\Omega^{O}_{Y_I}+\varepsilon_i \\
\Delta E &= \alpha_0+\alpha_1 Y_{t-1}+\alpha_2 P_{t-1}+\alpha_3\Delta Y+\alpha_4\Delta P_{18-21}+...+\alpha_9\Delta P_{65+}+\sum_{i=10}^{k}\delta_i\Gamma^{a}_{E_I}+\sum_{i=k+1}^{n}\alpha_i\Omega^{O}_{E_I}+\varphi_i
\end{aligned}
\tag{21}
$$

Estimating equation (21) helps identify the drivers of population dynamics, and the economic development implications of such dynamics, potentially information talent and population attraction

and retention strategies. Estimation of the system of equations in (21) is carried away through a two-stage-least-squares estimation procedure. In the first stage, endogenous variables in the system are identified using instrumental variables. In the second step, the instrumented endogenous variables are utilized to identify the system of equations. To make sure that the model is completely identified, the rank and order conditions of identifiability are thoroughly checked. Heteroskedasticity and multicollinearity are also common problems in large-scale cross section data. Both are addressed through alternative estimation procedure and through data transformation.

Data: Endogenous and Exogenous Variables in the Model

The following categories of data are included as explanatory variables in the model, for the 1990-2000 time periods. *Endogenous Variables* - changes in cohort population, employment and per capita income. *Initial Condition Variables* - the 1990 values of cohort population, employment and per capita income. *Housing Market Variables* - median home value and rent-to-income ratio as an indicator of place cost of living. *Education Variables* - the 1990 number of colleges, universities and other higher education institutions, and the percent of the population with a Bachelor's degree. *Role of Government Variable* - the 1990 ratio of per capita taxes to per capita expenditure. *Green Infrastructure Variables* - constructed from large amenities dataset from National Outdoor Recreation Supply Information (NORSIS) transformed into indices using the principal components method. These include Developed Amenities Index[4], Land Amenities Index[5], Winter Amenities Index[6], Water Amenities Index[7] and Climate Amenities Index[8]. *Economic Structure Variables* - the 1990 levels of % total employment in manufacturing, farming, services and finance sectors. *Other*

---

[4] *Developed amenities index* is developed based on: number of parks and recreational departments; tour operators and sightseeing tour operators; playgrounds and recreation centers; private and public swimming pools; private and public tennis courts; organized camps; tourist attractions and historical places; amusement places fairgrounds; local, county or regional parks; private and public golf courses; and greenway trails.

[5] *Land Amenities Index* is developed based on: number of guide services; hunting/fishing preserves, clubs and lodges; private campground sites; Bureau of Land Management public domain acres; mountain acres; NRI estimated crop, pasture and range land acres; USDA Forest Service forest and grassland acres; Forest and Wildlife Services refuge acres open for recreation; private and public campground sites; National Park Service federal acres; NRI forest acres; rail-to-trail miles; state park acres; acres of private forest land; the Nature Conservancy acres with public access; National wilderness preservation system acreage; and acres managed by Bureau of Reclamation, Tennessee Valley Authority and Corps of Engineers.

[6] *Winter Amenities Index* is developed based on: number of cross-country ski areas, firms and public centers; International Ski Service skiable acreage; federal land acres, agricultural acres, mountain acres, and forestland acres in counties with >24 inches of annual snowfall.

[7] *Water Amenities Index* is developed based on: number of marinas; canoe outfitters, rental firms and raft trip firms; diving instruction or tours and snorkel outfitters; guide services; fish camps, private or public fish lakes, piers and ponds; total white water river miles; designated wild and scenic river miles; NRI acres in water bodies: 2-40 acres. <2 acres, and >=40 acres; NRI stream 66' wide, 66-660' wide, and >= 1/8 miles wide water body; NRI water body >= 40 acres; NRI wetland acres; and NRI total river miles.

[8] *Climate Amenities Index* is computed based on: average July temperature; number of sunlight days; and average January temperature.

Variables - the 1990 values of % employment in the creative class, sustained innovativeness (average number of patents from 1990-1993), the Racial Diversity Index and rent, dividend and interest income. *Regional Dummy Variables* were included to identify regional differences.

The data used for this county-level, nation-wide metro and non-metro counties study, on the drivers of cohort-level population dynamics and its impact on employment and income growth, are from U.S. Censuses for 1990 and 2000, County Business Patterns, National Outdoor Recreation Supply Information (NORSIS) and Regional Economic Information System (REIS). Other sources include the U.S. Patent and Trademark Office, U.S. Department of Agriculture Forest Service, National Park Service and The Nature Conservancy.

[Table 1 about here]

Empirical Findings: Cohort-Level Population Dynamics and Economic Development

Determinants of Cohort-Level Population Dynamics

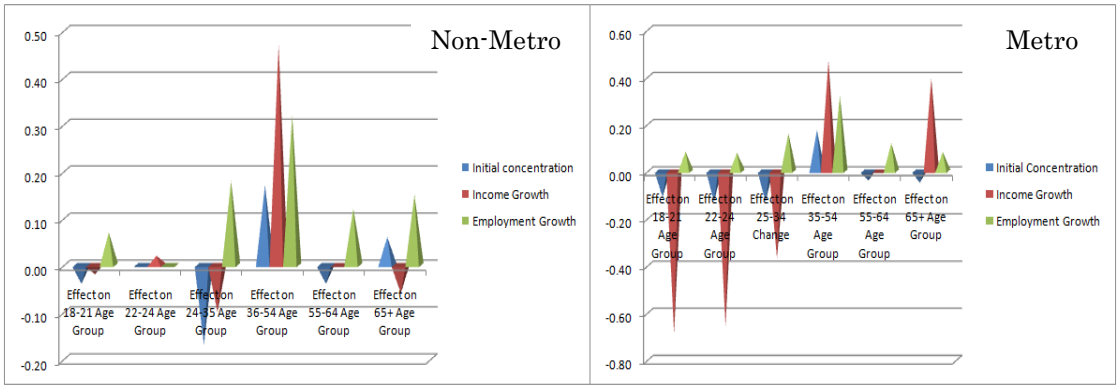
In identifying factors that are closely associated with cohort-level talent-laden population dynamics, equation (21) is implemented using different categories of variables: initial population and economic conditions; housing market and cost-of-living conditions; talent concentration and knowledge infrastructure; taxes relative to expenditure; diversity; natural and built amenities; and regional characteristics. The model performance, through R^2, of each of the cohort-population equation in the metro counties application are 59%, 62%, 61%, 92% and 69% for the 18-21, 22-24, 25-34, 35-54, 55-64 and 65+ year olds change equations, respectively. The model performance in the context of metro counties was robust, especially for cross-sectional analysis. In the context of non-metro, mostly rural, counties analysis, the model performance was 19%, 51%, 40%, 76%, 53% and 47% for the 18-21, 22-24, 25-34, 35-54, 55-64 and 65+ year olds change equations, respectively. Though the rural model performed relatively lower than metro models, the explanatory power of equations is encouraging. Each of the categorical factors is analyzed next. Note that econometric estimates are provided in bar-graphs that are easier to cross compare between metro and non-metro counties, to inform differential strategies for population and talent attraction and retention in these two settings. Bar-graphs that are on the x-axis (zero value) suggest that that particular variable was not significant.

Roles of Initial Concentration of Cohort-Population and Economic Activity

The initial concentration of cohort-level population is significantly related to subsequent patterns. Initial concentration of the 35-54 year olds in both metro and non-metro counties has a positive role in the growth of this group in subsequent periods. In non-metro counties, retirees have also a tendency to stay, and their initial concentration is a good predictor of their subsequent

location preference. For all other age groups in both metro and non-metro counties, there is significant divergence in that places that initially anchored these age groups have a tendency to lose them in subsequent years. In other words, the young are particularly more dynamic and mobile, and they tend to prefer new locations, compared to their initial concentration. Retirees are also dynamic in metro counties, though they have a tendency to stay in non-metro counties. Similarly, economic development, in terms of concentration of employment opportunities, matters to almost all age groups, but the importance of jobs to location choice increases until the 35-54 age group, then remains important but at a diminishing rate. This pattern is consistent in urban and rural economies, but retirees in metro counties seem to still marginally prefer locations with better employment prospects. Per capita income seems to be a strong appeal to the 35-54 age group in metro and non-metro counties, but particularly more important to urban retirees. Non-metro retirees seems to prefer low income locations instead, perhaps explainable by rural environments. In general, employment opportunities are crucial to population attraction across all age groups, while income seems to be relevant to older population groups. The young seem to be more dynamic and mobile, and places that anchor them may not succeed in keeping them for long without appropriate strategies that appeal to them.

Figure 1. Roles of Initial Concentration of Cohort-Level Population and Economic Conditions on Subsequent Changes - Non-metro and Metro Comparisons.

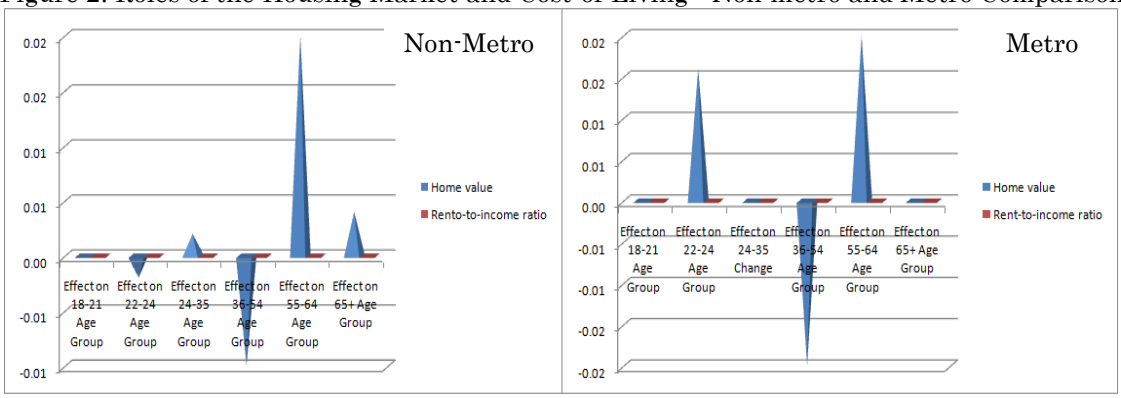


Roles of Housing Market Characteristics and Cost-of-Living

Some communities have adopted affordable home policies to attract talent and population. They also perceived high cost-of-living as a deterrent to such efforts. Results, shown in Figure 2, suggest that there is no systematic relationship between cohort-level population dynamics and cost-of-living. Expensive places to live have no less of an opportunity to attract talent and population compared to low cost environments. This may come at a significant disadvantage to rural communities where the cost-of-living has been promoted as an attraction strategy. Home values, indicator of housing market conditions, seem to be important to select age groups. There seems to be

a slight response to home values by the young age groups in non-metro counties, compared to metro counties where rising home values are actually beneficial. The 35-54 year olds are bargain hunters when it comes to property values, and they tend to prefer affordable home environments, though such environments are deterrents to attractions strategies for the 55-64 year olds in both metro and non-metro counties, and retirees in rural areas. The story of property markets is thus complex. While affordable homes appeal to middle-age groups, and the young in rural areas, rising home value environments are actually preferred by pre-retirement and retiree age groups. Thus, due to these trade-offs, population attraction strategies that rely on affordable home policies will need to properly target responsive age groups to such strategy, while promoting healthy real estate markets that appeal to older age groups, that may rely on such properties as a form of wealth accumulation.

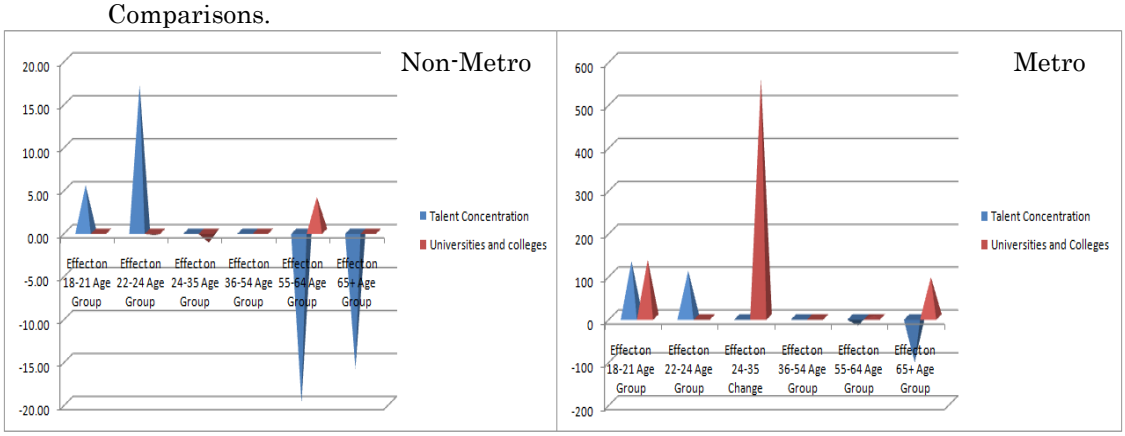
Figure 2. Roles of the Housing Market and Cost-of-Living - Non-metro and Metro Comparisons.



Roles of Talent Concentration and Knowledge Infrastructure

Recent strategies of talent and population attraction are centered on the development of talent agglomeration, partly by leveraging knowledge infrastructure. In both metro and non-metro counties, talent agglomeration strategies are effective in attracting younger age cohorts, but such strategies are either neutral or counter-productive when it comes to older age groups. Retirees are particularly less attracted to places with high concentration of talent. Talent attraction and retention strategies are thus more effective with the young age cohorts, but the potential crowd-out effects on retirees will need to be carefully weighed. Knowledge infrastructure is much less effective in rural communities, and seems to be effective in anchoring the young and retiree age groups in metro counties. Colleges, universities and research centers can be targeted as both young and retiree talent attraction, though such strategies are likely to be ineffective in rural areas.

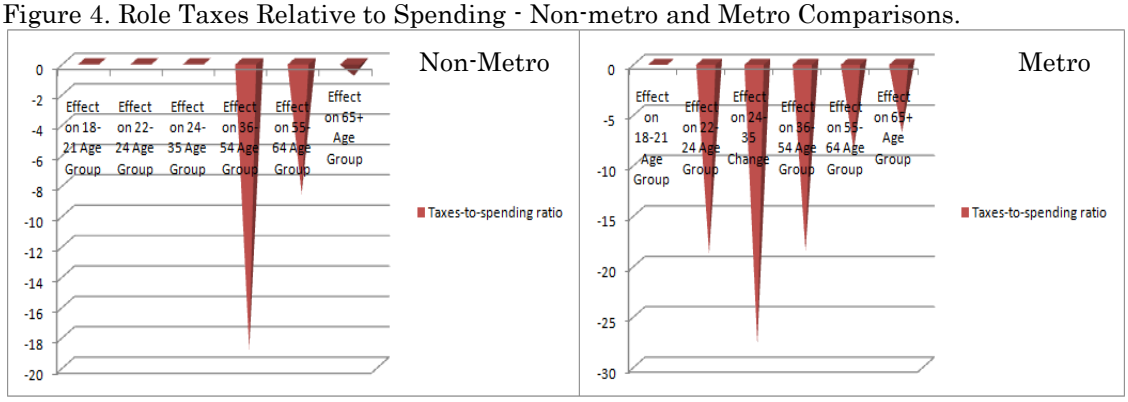
Figure 3. Roles of Talent Concentration and Knowledge Infrastructure - Non-metro and Metro Comparisons.



Role of Taxes, Relative to Services

Tax-based competition, through the race-to-the-bottom, was and continues to be a popular strategy to business and population attraction. Results, shown in Figure 4, show that there is a general negative response to taxes, relative to services, by almost all age cohorts in metro counties, and by 36 and older population in non-metro counties. Though at a smaller margin, there is credence to the observation that low tax communities have an advantage in attracting a series of population groups. This strategy, however, seems to be ineffective to the young age group attraction and retention in non-metro counties. The higher tax sensitivity in metro counties, compared to non-metro ones, is unexpected, but can be explained by perhaps better information about taxes and services in urban areas, and perhaps the already higher tax structure in urban economies that may make marginal increases in taxes a more difficult task.

Figure 4. Role Taxes Relative to Spending - Non-metro and Metro Comparisons.

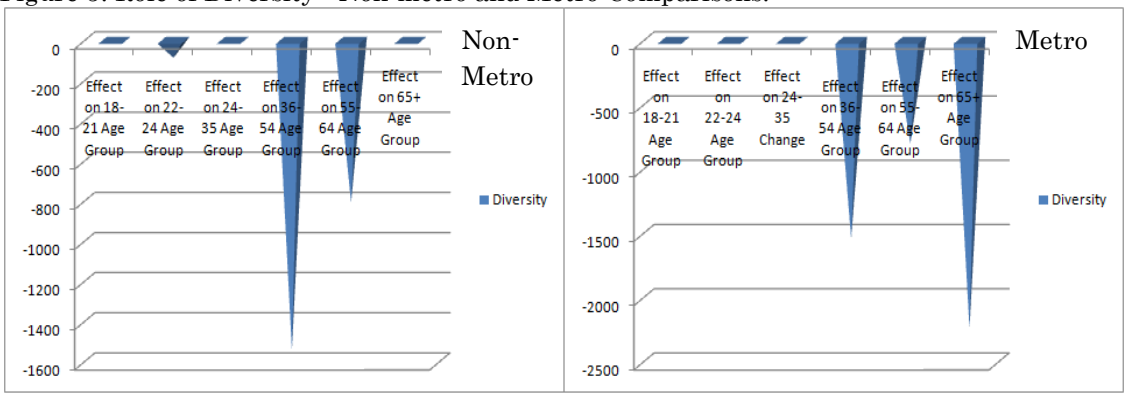


Role of Population Diversity

Recent works, by Florda (2000, 2002a, 2002b) suggest the importance of diversity to attractiveness of places to talent. Results, shown in Figure 5, however show that while the young seem to be neutral to diversity, older age groups are attracted to homogenous places. Two issues may

have caused this result – one, the focus on a county, as opposed to urban cores where prior studies tend to focus, and two, our measure of diversity focuses only on racial diversity, and not on industrial, cultural or any other form of diversity mentioned in prior studies. Nonetheless, there seems to be preference to homogeneity.

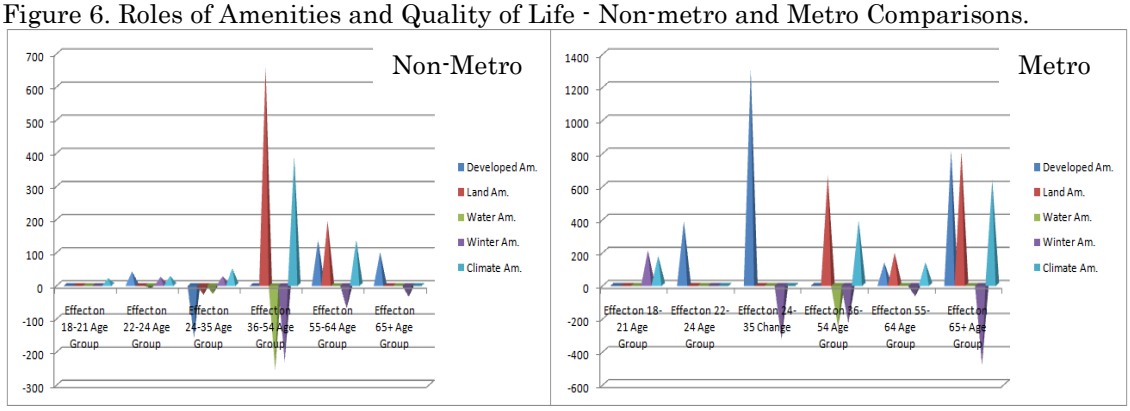
Figure 5. Role of Diversity - Non-metro and Metro Comparisons.



Role of Amenities and Quality of Life

The role of amenities and quality of life as a population attraction strategy to rural areas has been widely discussed in the literature (Deller, et al., 2001; Chen and Rosenthal, 2008; Clark, et al., 1996; Bennett, 1996; Judson, 1999; Shields, et al., 2001). Results from this study confirm that amenities and quality of life attributes are crucial to cohort-level population dynamics, but caution that there are differential effects. Developed amenities are associated with the growth of the young and retiree age cohorts in metro counties, and the 55-64 age group and retirees in non-metro counties. Land amenities are relevant to the 36-64 age groups in non-metro counties and older age groups, particularly retirees, in metro counties. Water and winter amenities are relatively less effective, while climate amenities are desirable by almost all age groups in metro and non-metro counties, but more so by middle-age rural population and retiree urban population. In general, though the non-homogeneity of amenity preference in location choice by each age cohort should be recognized in more strategic and nuanced policies, amenities and quality of life is an important consideration and strategy in talent and population attraction and retention.

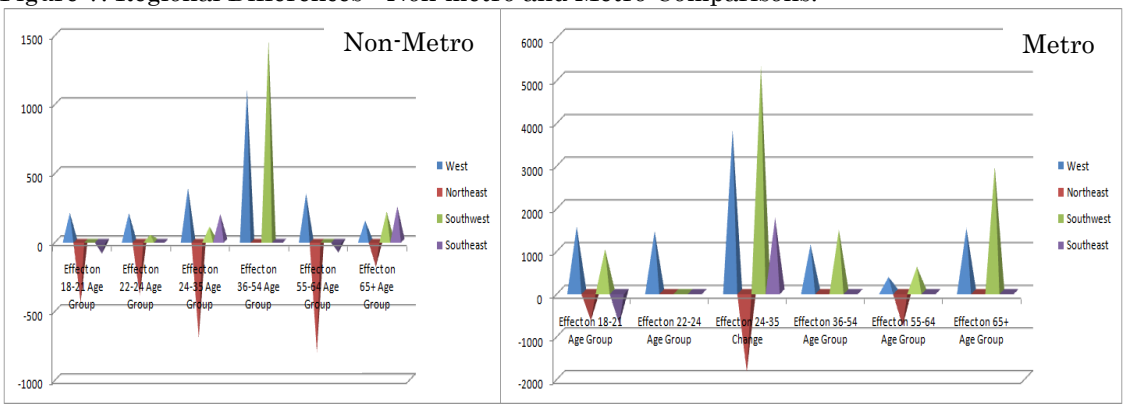
Figure 6. Roles of Amenities and Quality of Life - Non-metro and Metro Comparisons.



Regional Differences in Cohort-Level Population Dynamics

Compared to the Midwest region (the *numeraire*), the West region is better positioned in attracting all age groups in both metro and non-metro economies. Similarly, the Southwest region is also mostly better positioned in attracting almost all age groups, particularly in metro counties. The Southwest doesn't fare much better, except in the 24-35 age group in metro counties and the same age group and retirees in non-metro counties. The Northeast is the only region that is performing worse than the Midwest, in almost all age groups in non-metro counties and in select age groups in metro economies. In general, the Northeast and the Midwest are particularly structurally hampered in attracting population cohorts. The task of designing and implementing such strategies becomes more difficult in these states, though perhaps more relevant and timely.

Figure 7. Regional Differences - Non-metro and Metro Comparisons.



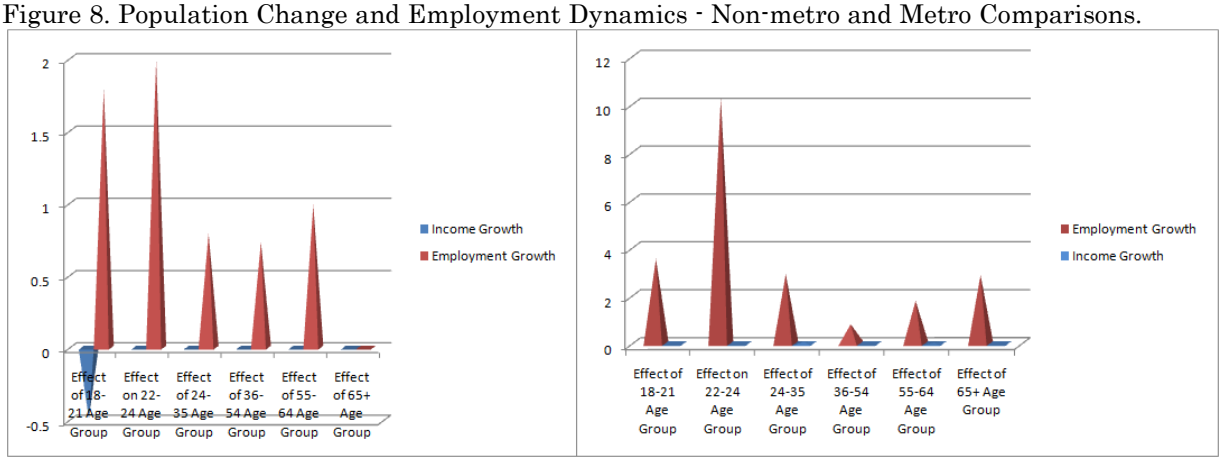
The Implications of Cohort-Level Population Dynamics on Economic Development

Next, consider the relevance of population and talent attraction and retention strategies in the context of economic development. Employment and income growth, two indicators of a vibrant local and regional economy, are evaluated vis-à-vis population dynamics.

Impacts of Population Dynamics on Employment and Per Capita Income Growth

Consistent with prior studies (Deller, et al., 2001; Hailu and Brown, 2007), population attraction of any age group is beneficial to employment growth. The two are simultaneously related – prosperous places create jobs, which attract population, but population growth also enhances prospects for employment expansion tied to greater aggregate demand. However, the differential employment growth effects of age groups are different. In non-metro counties, the marginal employment impact of population attraction are relatively lower than urban economies, however, the young have the largest employment impact than the middle-aged cohorts, though the marginal impact increases in the pre-retirement age group. Attraction of retirees to non-metro counties has no clear employment benefits. Metro counties also feature similar trends, where younger age groups enhance employment growth, but retirees also count. These results suggest that while the economic development benefit from population attraction is generally positive, younger age groups have the most positive impact than others. Retiree attraction for employment growth seems to be only relevant in urban settings. Income is a different case. Per capita income takes longer time to grow, and even though income dynamics is tied to population dynamics, it is much less sensitive to these forces than employment changes.

Figure 8. Population Change and Employment Dynamics - Non-metro and Metro Comparisons.



Conclusion and Policy Implications

This study evaluated the drivers of cohort-level talent-laden population dynamics to identify key factors that could be relevant to population and talent attraction and retention strategies. In so doing, a system of equations model that captures dynamics in the young to retiree age cohorts are identified. By utilizing national data on metro and non-metro counties, key similarities and differences in factors that determine population dynamics are identified. Such important factors as initial performance (path-dependence), housing market conditions and cost-of-living, talent concentration and knowledge infrastructure, taxes relative to services, diversity, amenities and quality of life and regional differences are examined to inform attraction and retention strategies. In

a second stage analysis, the implications of cohort-level population dynamics to economic development is also evaluated, with a focus on employment and per capita income growth.

Results from the analyses generally suggest that the young age group is the most spatially mobile in both metro and non-metro counties; while cost-of-living differences are not much relevant, home values and affordable homes matter to middle-age cohorts; agglomeration of talent appeals to the young, while existence of knowledge infrastructure is relevant to population attraction in urban settings; taxes, relative to services, matter in both metro and non-metro environments, though metro residents are more sensitive to it; amenities and quality of life matter, but there are significant differences between metro and non-metro responses, and what each age cohort prefers compared to others; and that there are significant regional differences in the ability to attract and retain cohort-level population. Moreover, this study establishes that population dynamics has significant implications to economic development. While the attraction of population seems to be across-the-board beneficial in both metro and non-metro economies, attraction of the young are particularly more effective in employment growth, followed by retirees. Income growth, however, seems to be less sensitive to population dynamics.

There are numerous policy implications that emanate from these findings. First, the fact that metro and non-metro counties have different response functions to drivers of population dynamics suggest that even though population and talent attraction strategies in both settings can be leveraged and harmonized, there are unique differences between the two. These structural differences will need to be carefully evaluated in nuanced population and talent attraction and retention strategies. Second, the fact that different drivers of population dynamics have varying marginal effects on population groups, the marginal effectiveness of policies that rely on one tool, vis-à-vis others, will need to be carefully evaluated. Three, the fact that different age cohorts respond in varying manner to key drivers, a homogenous population attraction strategy that doesn't differential by age cohorts is less likely to have the desired effect. Differentiated and targeted approaches seem to be more effective. Four, the utilization of certain population attraction strategies involve trade-offs and crowding-out effects. For instance, affordable homes appeal to middle-aged population, while disincentives attraction of pre-retirement and retiree population. These countervailing forces and unintended reactions will need to be evaluated in advance to design efficient talent and population attraction strategies.

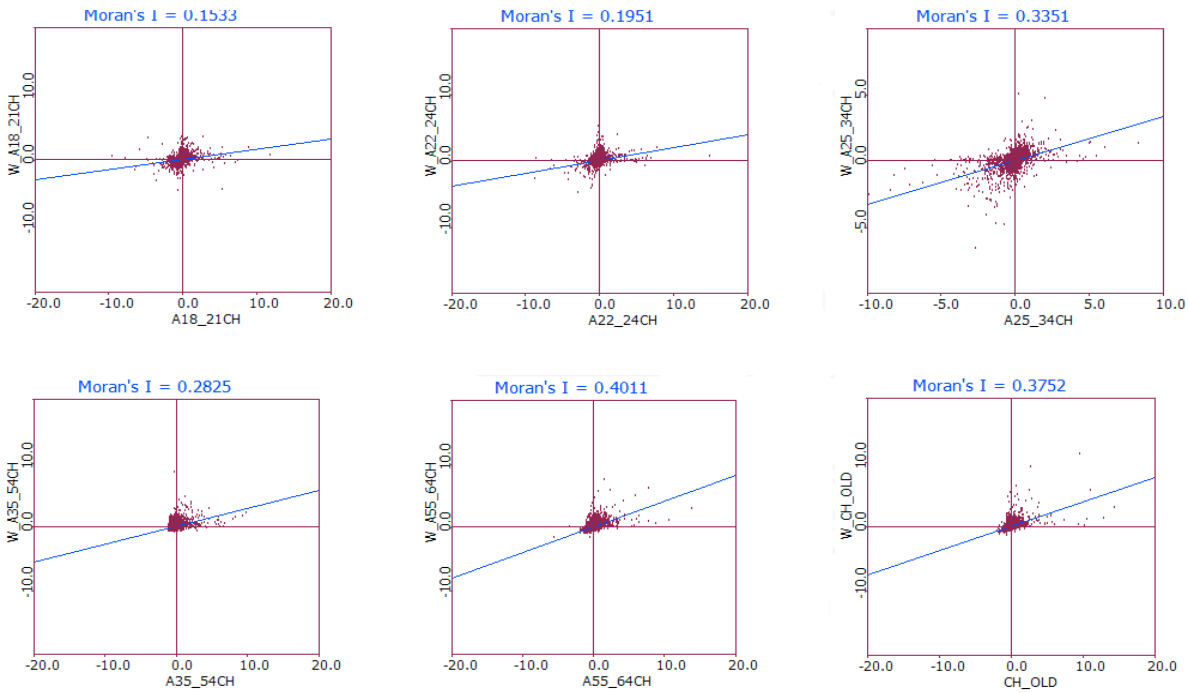
The "new economy" has made it essential for communities to attract talent and targeted population. The competition for these strategic community assets will intensify with the predominance of the knowledge-economy. As communities compete for the attraction and retention of these assets in advancing their economic development and prosperity, what drives population and

talent movement, and what strategies can anchor them becomes relevant. This study provides some preliminary insights into effective talent and population attraction strategies through the use of cross-sectional analysis of communities. Results, overall, seem to support a targeted strategy that is sensitive to regional differences, response disparities between stimuli and population dynamics, as well as across population groups. The economic development impact of different age groups is not homogenous. This further supports the need for a targeted and nuanced strategy to anchor talent and population in the "new economy."

Final Note on Inter-governmental Cooperation on "New Economy" Assets

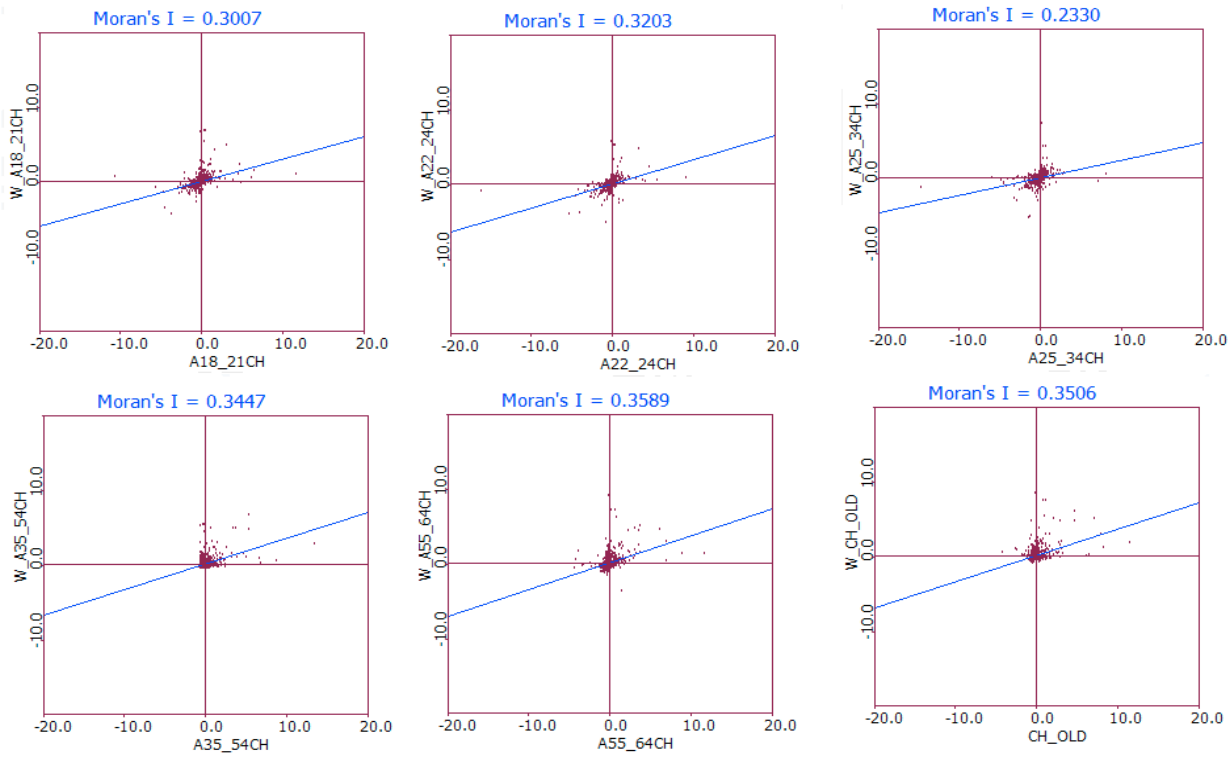
So far, strategies for population and talent attraction are discussed. One final note seems appropriate at this juncture. Population and talent attraction efforts can be cost-prohibitive, including incentives to keep knowledge-workers in the local economy. For instance, some places offer tuition cost-recovery for students in targeted fields to incentivize their stay in the regional economy for a predetermined number of years. It is important to recognize that there are significant spatial spillovers in population dynamics. For instance, in the context of non-metro counties, there is strong spatial correlation between the mobility of 25-34 year olds, 55-64 year olds and retirees and similar age groups in neighboring non-metropolitan counties (see Figure 9). This offers a unique opportunity to design inter-jurisdictional collaboration and regional plans to attract and retain talent regionally.

Figure 9. Spatial Statistics of Cohort-Level Population Change in U.S. Non-Metro Counties.



In metro counties, the benefits of inter-jursidictional collaboration in anchoring "new econoym" assets is even more strong (see Figure 10). With the exception of the 25-34 year olds, all other age groups show strong spatial interdependence. This offers a window of opportunities for regions to pull through resources and to launch regional talent and targeted population attraction and retention strategies. This requires changing mindsets and incentive systems regionally to encourage the developmetn of encompassing strategic plans for talent attraction and retention that recognize and utilize spillover benefits to the retgion.

Figure 10. Spatial Statistics of Cohort-Level Population Change in U.S. Metro Counties.



Appendix

Table 1. Variable Descriptions and Descriptive Statistics.

Variable	Description	Mean	Std. Dev.	Min.	Max.
Endogenous Variables[1]					
ΔA18_21	Change in population aged 18 - 21 (1990-2000)	169.03	2,159.16	-43,537	49,589
ΔA25_34	Change in population aged 25 - 34 (1990-2000)	-1,015.58	6,219.36	-176,077	95,161
ΔA35_54	Change in population aged 35 - 54 (1990-2000)	6,309.35	19,158.14	-191	484,066
ΔA55_64	Change in population aged 55 - 64 (1990-2000)	985.05	3,477.76	-24,033	78,761
Δ65_plus	Change in population aged 65 and over (1990-2000)	1,203.59	4,265.10	-26,992.00	93,722
ΔE	Change in total employment (1990-2000)	8,779.00	29,625.00	-61,902	656,304
ΔY	Change in Per Capita Income (1990-2000)	7,770.64	3,053.85	-9,189.00	46,390.00
Initial Condition Variables[1]					
pop_90	Resident population (complete count) 1990	77,376	260,929	107	8,863,164
Emp90	Total employed persons in 1990	42,739	159,037	95	5,353,918
IncPC_90	Per capita personal income 1990	15,235.03	3,446.47	5,479.00	35,318.00
Demographic Variables[1]					
A18_21_90	Population age 18 - 21 in 1990	4,844.17	16,684.54	6	598,788
A25_34_90	Population age 25 - 34 in 1990	13,364.89	49,968.85	18	1,757,799
A35_54_90	Population age 35 - 54 in 1990	19,541.76	65,517.20	25	2,182,024
A55_64_90	Population age 55 - 64 in 1990	6,593.33	20,764.10	15	647,608
A65p_90	Population age 65 plus in 1990	9,743.93	29,600.78	14	860,587
UrbanP_90	% urban population in 1990	35.77	29.10	0	100
ForBrP90	% foreign born population in 1990	6,048.00	61,972.93	0	2,895,066
MgT_91	Net migration from 7/1/90 to 9/1/91	216.00	2,883.00	-87,847	44,344
Housing Market Variables[1]					
MedHoV90	Median value of specified owner-occupied housing units 1990 (complete count)	52,831.16	31,459.34	14,999.00	452,800.00
RentInc90	Median rent payment divided by per capita income in 1990	234.14	95.51	99	763
Education Variables					
EdBAp_90[1]	Persons 25 years and over - % bachelor's degree or higher in 1990	13.34	6.36	3.7	53.4
UniCol[2]	Number of Colleges, Universities and Professional Schools for the year 2005 (NAICS code 611310)	1.1	5.07	0	162

Table 1. Continued.

Variable	Description	Mean	Std. Dev.	Min.	Max.
Role of Government Variable[1]					
GExpPC92	Local government finances - direct general expenditures per capita FY 1992	1,859.60	788.46	162	9,815.00
Green Infrastructure Indices[4]					
DevAmIdx	Development amenity index	-0.01	2.45	-1.07	59
LndAmIdx	Land amenity index	0.004	1.93	-1.15	21
WatAmIdx	Water amenity index	-0.0009	1.56	-0.09	24
WintAmIdx	Winter amenity index	0.004	1.48	-0.03	26
CliAmIdx	Climate amenity index	-0.008	1.81	-4.57	4.31
Regional Dummy Variables[5]					
Midwest	Dummy variable for the Midwest region	0.35	0.48	0	1
West	Dummy variable for the West region	0.12	0.33	0	1
Northeaast	Dummy variable for the North East region	0.08	0.27	0	1
SouthEast	Dummy variable for the South East region	0.33	0.47	0	1
SouthWest	Dummy variable for the South West region	0.13	0.33	0	1
Economy Structure Factors[6]					
Pmanuf	% Manufacture Class Employment 1987	14.66	10.64	0	61.53
PFarmEmp	% Farm Class Employment 1988	4.66	2	0	16.97
PFinRE9	% Financial Class Employment 1989	11.06	10.01	0	70.9
PSrv90	% Service Class Employment 1990	20.25	6.85	0.01	63.80
Other Variables					
PCrTot90[1]	% Creative Class Employment 1990	25.46	6.35	9.08	62.46
PAT90-93[7]	Average Patents (1990-1993)	16.41	74.75	0	1,671.25
RcIdx_90[1]	Racial Diversity Index (Simpson's Diversity Index) 1990	0.17	0.17	0.001	0.68
IntDivRnt90[1]	Rent, Dividend, Interest Income 1990	299,210.29	1,181,875.50	1,111.00	37,530,048

n=3,023

Sources: 1) U.S. Bureau of the Census; 2) County Business Patterns; 3) Cleveland Federal Reserve Bank; 4) National Outdoor Recreation Supply Information (NORSIS) 1997; 5) Constructed Variables; 6) Regional Economic Information System (REIS); 7) U.S. Patent and Trademark Office

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