JOURNAL OF REGIONAL SCIENCE

JOURNAL OF REGIONAL SCIENCE, VOL. 51, NO. 2, 2011, pp. 253–270

WHY ARE SMART CITIES GROWING? WHO MOVES AND WHO STAYS*

John V. Winters

Department of Economics, Auburn University at Montgomery, P.O. Box 244023, Montgomery, AL 36124-4023. E-mail: jwinter3@aum.edu

ABSTRACT. This paper examines why smart cities are growing by investigating who moves to smart cities and who stays. Smart cities are often centers of higher education, so students moving to pursue higher education may play an important role. I find that the greater in-migration to smart cities is mostly due to persons enrolled in higher education. Smart cities are growing in part because in-migrants often stay in the city after completing their education. The growth of smart cities is also mostly attributable to population redistribution within the same state and has little effect on population growth at the state level.

1. INTRODUCTION

A considerable body of literature has shown that the stock of human capital in a metropolitan area, measured as the share of the adult population with a college degree, is a strong predictor of future population growth.[1] Berry and Glaeser (2005) also show that the share of the adult population with college degrees has increased more quickly in cities with higher initial levels of schooling.[2] There is still no consensus, however, as to why "smart cities" are growing. A popular hypothesis is that workers move to cities with high levels of human capital because these cities are more productive. Several studies have shown that wages in highly educated cities are higher than in less educated cities, even after controlling for individual worker characteristics (e.g., Rauch, 1993; Glaeser and Saiz, 2004; Moretti, 2004a). The interpretation is often that proximity to educated individuals makes other workers more productive, though this interpretation is questioned by some.[3] This interpretation also finds support in the geographic localization of patent citations found by Jaffe et al. (1993). Jaffe (1989), Audretsch and Feldman (1996), and Adams (2002) also find that university research has important spillover effects on nearby firms for both R&D and corporate patents.

Another explanation for the connection between population growth and human capital is that an educated populace increases the quality of life in a city and people flock to the city for the higher quality of life (Shapiro, 2006). Educated individuals might increase the quality of life in a city in a number of ways. They may be less likely to commit crimes, more likely to vote, more likely to support local art and other cultural amenities, and more tolerant of others different from themselves (Florida, 2002).

---

*The author thanks the Editor, two anonymous referees, Barry Hirsch, Jon Rork, and seminar participants at Georgia State University for helpful comments. The usual caveat applies.

Received: December 2008; revised: October 2009, January 2010; accepted: February 2010.

[1]See, for example, Glaeser et al. (1995); Simon (1998, 2004); Black and Henderson (1999); Simon and Nardinelli (2002); Glaeser and Shapiro (2003); Glaeser and Saiz (2004); and Shapiro (2006).

[2]Throughout this paper, I use the term city to refer to an economic city, which usually includes more than just a single municipality. In practice, this is more akin to the census concept of a metropolitan area. Thus, the terms city and metropolitan area are used interchangeably in this paper.

[3]For reviews of the literature on human capital externalities, see Moretti (2004b) Lange and Topel (2006), and Henderson (2007).

 DOI: 10.1111/j.1467-9787.2010.00693.x

In this paper, I examine why smart cities are growing by looking at who moves to smart cities and who stays. Following Shapiro (2006) and others, I consider "smart cities" to be metropolitan areas with a large share of the adult population with a college degree.[4] These smart cities are often small and mid-size metropolitan areas containing flagship state universities. As a result, students moving to pursue higher education may play an important role in the relationship between human capital and urban population growth.[5] Students who move to an area for higher education and develop human capital that is specific to that area are often likely to stay in the area after their education is complete. Consequently, smart cities may be growing in part because of students moving to pursue higher education and then staying in the city after they are done with their education. I investigate this hypothesis by examining the relationships between migration and the share of the adult population who are college graduates separately for individuals enrolled in higher education and for individuals not enrolled. The results suggest that most of the greater in-migration to high human capital cities is due to persons pursuing higher education. It seems likely, though, that many of those who move to pursue higher education will leave the metropolitan area after their education is complete, and I find that high human capital cities also have high rates of out-migration. On net, though, high human capital cities gain more people than they lose causing them to grow. This paper, therefore, suggests that much of the population growth of smart cities in recent years is due to students moving to smart cities for higher education and then staying after their education is complete.

I also find that the bulk of the net migration to high human capital cities comes from within the same state, consistent with students moving to pursue higher education within their home state. This has important implications for state policy makers. Population growth in high human capital cities does not equate to population growth at the state level. Instead, the growth of high human capital cities is largely due to population redistribution within the state.

2. CONCEPTUAL FRAMEWORK

This paper adopts the approach of a large literature following Sjaastad (1962) that views migration as an investment in human capital. Individuals maximize expected utility and an individual migrates if he expects the benefit from moving to exceed the cost. In other words, an individual will move if an alternative location offers a higher utility than his current location and the utility differential is sufficiently high to compensate the individual for the costs of moving (e.g., the transaction costs involved in finding a new residence and relocating one's physical possessions). If the costs of migration are sufficiently small, individuals will sort into the city that gives them the highest possible utility.

Importantly for this study, individuals vary in the net benefits they receive from moving to a particular location. For instance, Clark and Hunter (1992), Conway and Rork (2006), Chen and Rosenthal (2008), and Plane and Jurjevich (2009) find that the young and the elderly are attracted to different locations. The young are often attracted to areas with high wages and a strong business environment, while the elderly are attracted to

[4] As a practical matter, however, this paper does not define a specific set of cities as smart cities, that is, there is no cutoff defined to determine whether a city is smart or not.

[5] De la Garza (2008) suggests that the growth of smart cities is not solely due to the growth of college towns, but his categorization of cities as college towns is a less direct way of examining the role played by enrollment than the approach taken here.

TABLE 1: The 20 Most Educated Cities in 1990

Rank	MSA/PMSA	% with Bachelor's Degree or Higher
1	Iowa City, IA MSA	44.0
2	Stamford-Norwalk, CT PMSA	43.1
3	Boulder-Longmont, CO PMSA	42.8
4	Corvallis, OR MSA	41.3
5	Lawrence, KS MSA	38.4
6	Washington, DC-MD-VA-WV PMSA	37.0
7	Columbia, MO MSA	36.5
8	Bryan-College Station, TX MSA	35.8
9	Danbury, CT PMSA	35.8
10	Santa Fe, NM MSA	35.7
11	San Francisco, CA PMSA	34.9
12	Gainesville, FL MSA	34.6
13	Madison, WI MSA	34.2
14	Champaign-Urbana, IL MSA	34.1
15	Charlottesville, VA MSA	33.3
16	Bloomington, IN MSA	32.9
17	San Jose, CA PMSA	32.6
18	Tallahassee, FL MSA	32.4
19	Boston, MA-NH PMSA	32.3
20	State College, PA MSA	32.3

areas with a high quality of life but low cost of living. Similarly, individuals likely differ in the extent to which they benefit from moving to a high human capital city.

In particular, this paper suggests that students may particularly benefit from moving to smart cities because smart cities are often centers of higher education. Table 1 lists the top 20 metro areas (out of 331) by the share of adults (age 25 and over) with at least a bachelor's degree in 1990.[6] Iowa City, Iowa tops the list with an impressive 44.0 percent of adults with college degrees, while State College, Pennsylvania ranks 20th of the 331 cities with 32.3 percent. Interestingly, a number of the most educated cities are relatively small metropolitan areas surrounding major public universities. Iowa City is home to the University of Iowa and State College is home to the Pennsylvania State University. Additionally, Boulder is home to the University of Colorado, Corvallis to Oregon State University, Lawrence to the University of Kansas, Columbia to the University of Missouri, Bryan-College Station to Texas A&M, Gainesville to the University of Florida, Madison to the University of Wisconsin, Champaign-Urbana to the University of Illinois, Charlottesville to the University of Virginia, Bloomington to the University of Indiana, and Tallahassee to Florida State University. Because many of the most educated cities are home to major universities, persons pursuing higher education may constitute a disproportionately large share of the persons moving to smart cities. For those pursuing higher education, moving to a university town may be their best choice, but persons not pursuing higher education may find moving to a university town less desirable.[7]

[6]Data come from the Department of Housing and Urban Development (HUD) State of the Cities Data System based on the 1990 Census of Population and Housing.

[7]Flagship universities are likely to draw students from all over the state and to some extent from other states and countries (Alm and Winters, 2009).

If students move to university towns in large numbers, we might also expect persons who have recently completed their education to leave these cities in large numbers. Once their education is complete, many recent in-migrants are likely to move back to their previous residences or move on to new locations.[8] Previous literature, however, suggests that not all in-migrants leave the area after finishing their education. Some who moved to the city for higher education end up staying after their education is complete. For example, Groen (2004) and Groen and White (2004) find that attending college in a state increases an individual's probability of residing in the state several years later compared to had they not attended college there.[9] Similarly, Blackwell et al. (2002) find that attending Xavier University in Cincinnati increases the likelihood that an individual will locate in Cincinnati years later, and Huffman and Quigley (2002) find similar evidence for graduate students in the University of California, Berkeley's Haas School of Business and College of Engineering.[10]

College attendance likely affects postgraduate location decisions because students often develop location-specific human capital in both production and consumption (DaVanzo, 1983; Berry and Glaeser, 2005; Krupka and Smith, 2008; and Krupka, 2009). After living in a city for a few years, individuals may have gained human capital that makes them more productive locally than elsewhere. This can include networks with professors and other students and employment experience with local companies through internships and student working. Along these lines, Berry and Glaeser (2005) develop a model where entrepreneurs are relatively immobile because their innovations are location-specific. Recent migrants may also develop location-specific human capital in consumption. Having completed their education, people may stay in the same city because they have developed friendships and a taste for local amenities that makes living in the city more enjoyable. Thus, location-specific capital may motivate recent in-migrants to stay in a city after completing their education because they can achieve higher utility in the city than in any alternative location.

If location-specific human capital often inclines recent graduates to remain in the city where they completed their education, cities with a considerable university presence are likely to grow faster than cities without a strong university presence. Furthermore, students moving for higher education and then staying in the city after their education is complete may play an important role in the growth of smart cities. This hypothesis is not incompatible with previous explanations suggesting that smart cities are growing because they offer higher wages or higher quality of life. The difference, however, between this study and previous studies is that this study focuses on who benefits from moving to and staying in smart cities. In particular, I suggest that recent students may benefit more from living in a smart city where they attended college than persons who have never lived in the city. Thus, the growth of smart cities may be particularly influenced by the ability of smart cities to attract and retain persons pursuing higher education.

3. EMPIRICAL FRAMEWORK

Most studies interested in the growth of smart cities look at population growth over decennial years. Very few studies, however, examine who is moving to high human capital

[8]Franklin (2003) provides an insightful analysis of the migration of the young, single, and college educated.

[9]Hickman (2009) finds similar results for the state of Florida as a result of its "Bright Futures Scholarship Program."

[10]Drucker and Goldstein (2007) review the literature on the regional economic impacts of universities including a discussion of student migration.

cities.[11] In this study, I hope to gain insight into the connection between human capital and population growth by looking at who moves to smart cities. I look at migration directly, instead of population growth as is usually done. More specifically, I estimate

$$M_{in,j} = \beta_{in} S_j + \Gamma_{in} \mathbf{Z}_j + \varepsilon_{in,j}, \tag{1}$$

where $M_{in,j}$ is the rate of in-migration to metropolitan area j, S_j is the share of the adult population with college degrees in the metropolitan area, $\mathbf{Z}_j$ is a vector of other variables found in previous literature to affect metropolitan area population growth, and $\varepsilon_{in,j}$ is a mean zero error term. Following previous literature, time-varying explanatory variables are measured with a 10-year lag so that they are not affected by migration during the period under consideration. Because high human capital cities are often centers of higher education, I also expect that the human capital level in a city will be correlated with the rate of out-migration and estimate

$$M_{out,j} = \beta_{out} S_j + \Gamma_{out} \mathbf{Z}_j + \varepsilon_{out,j}, \tag{2}$$

where "out" subscripts the out-migration rate and its corresponding coefficients and error term. A metropolitan area will grow if the rate of in-migration exceeds the rate of out-migration. Thus, I also estimate the determinants of the net migration rate, obtained by subtracting (2) from (1)

$$M_{net,j} = \beta_{net} S_j + \Gamma_{net} \mathbf{Z}_j + \varepsilon_{net,j}, \tag{3}$$

where "net" subscripts the net migration rate and its corresponding coefficients and error term.

I first estimate the migration equations for the entire population, but this tells us little about who moves to high human capital cities. I, therefore, next estimate the migration equations separately for persons age 16 and over by whether they are enrolled in higher education. Computations from the Census 2000 Integrated Public Use Microdata Series (IPUMS) reveal that roughly 16 percent of all persons age 16 and over who lived in a different metropolitan area in 2000 than in 1995 were enrolled in higher education in 2000. If high human capital cities are growing because individuals move there to pursue higher education, then migration by those enrolled in college may constitute a disproportionately large share of the greater in-migration to high human capital cities. To add further evidence to my story, I also estimate the migration equations separately by five-year age groups. The expectation is that persons of college-going age might constitute a disproportionately large share of the total in-migration to high human capital cities. I also explore who moves to smart cities and who stays by estimating separate equations for individuals who move from within the same state and individuals who move from another state or country. In doing so, I am particularly interested in examining if the growth of smart cities is due primarily to interstate migration or intrastate migration. Public universities often get a large percentage of their students from within the same state, so it may be the case that smart cities are growing primarily through net intrastate migration.

4. DATA

The migration data used in this paper were constructed from the IPUMS (Ruggles et al. 2008) data for the 1980, 1990, and 2000 Censuses (5 percent samples). The data

[11]To my knowledge Berry and Glaeser (2005) is the only exception. In that study, they look separately at logarithmic changes in the college educated population and the noncollege educated population, but they do not look specifically at migration.

for the percent of adults with a college degree, metropolitan area population, median family income, and the share of employment in manufacturing come from two sources. For 1980 and 1990, the data for these variables come from the HUD State of the Cities Data System (U.S. Department of Housing and Urban Development, 2008) and are based on 1999 Primary Metropolitan Statistical Area definitions, while the 1970 data come from the 1972 County and City Data Book (U.S. Department of Commerce, Bureau of the Census, 1972) archived at the Interuniversity Consortium for Political and Social Research and are based on 1981 Standard Metropolitan Statistical Area definitions.[12] Data on temperature and precipitation come primarily from the 2007 County and City Data Book (U.S. Department of Commerce, Bureau of the Census, 2007) where metropolitan area values were assigned based on the values for their principal cities. For cities missing information in the 2007 County and City Data Book, information was obtained from the 2000 and 1988 County and City Data Books (U.S. Department of Commerce, Bureau of the Census, 1988, 2000). Metropolitan areas that crossed regions were assigned to the region in which the major principal city is located.

One complication with my analysis is that the IPUMS data do not allow identification of geographic areas with populations less than 100,000. As a result, the lowest level of identifiable geography in the IPUMS data, Public Use Microdata Area's (PUMA) in the 1990 and 2000 samples (county groups in the 1980 sample), often include both metropolitan and nonmetropolitan areas.[13] I, therefore, assign each PUMA (county group in 1980) to a metropolitan area if more than 50 percent of the population of the PUMA (county group) is contained within the metropolitan area. Using this procedure identifies 323 metropolitan areas in 2000, 298 in 1990, and 276 in 1980.

A person is considered a migrant if they lived in a different metropolitan area in the census year than they did five years prior.[14] Gross in-migration to a metropolitan area was computed by adding up the total number of migrants to the area using person weights. The same was done to compute gross out-migration from a metropolitan area. Note, however, that persons who exit the country are not in the sample, and hence out-migration does not include international out-migration. Checks of robustness suggest that international out-migration has little effect on the results. Net migration was computed as gross in-migration minus gross out-migration. Gross in-migration rates are computed by dividing gross in-migration by the population of the metropolitan area, defined according to PUMA (county group) boundaries consistent with the migration flows, five years prior to the census. The same is done to compute gross out-migration rates and net migration rates. When I split the migrant flows by enrollment status, age, and state of previous residence, I continue to use the total population of the metropolitan area as the population base to allow for easier interpretation of each groups' contribution to the overall flow.

Before proceeding to the results of the regression analysis, it is useful to first examine migration rates for different types of metropolitan areas based on their human capital stock. Table 2 presents mean migration rates for three groups of metropolitan areas based on the share of their adult residents with college degrees: (1) the top 20 percent of

[12]The results in this paper are qualitatively robust to using Combined Metropolitan Statistical Area definitions.

[13]Note also that PUMAs of previous residence often include more than one PUMA of current residence. To have consistent metropolitan boundaries, PUMAs of current residence were aggregated to correspond with PUMAs of previous residence.

[14]Unfortunately, there may be problems with misreporting of previous residence, especially for persons who were attending college five years prior to the census. If so, the effects of the college share on out-migration may be understated and the effects of the college share on net migration may be overstated.

TABLE 2: Migration Rate Tabulations by Human Capital Level, 1995–2000

	In	Out	Net
Top 20% of cities by human capital ($N = 64$)	0.246	0.193	0.052
Middle 60% of cities by human capital ($N = 195$)	0.182	0.157	0.025
Bottom 20% of cities by human capital ($N = 64$)	0.157	0.140	0.017

metropolitan areas; (2) the middle 60 percent; and (3) the bottom 20 percent. The table shows that the average in-, out-, and net migration rates are largest for the "smartest" group of metropolitan areas.[15] In particular, the net migration rate for the smartest group is more than double that of the other two groups, consistent with findings from previous literature that more educated cities experience faster population growth than less educated cities. Similarly, the middle 60 percent of cities have higher net migration rates than the bottom 20 percent of cities.

5. EMPIRICAL RESULTS

Turning to the regression analysis, I first estimate the relationship between the share of adults with college degrees in 1990 and in-migration, out-migration, and net migration between 1995 and 2000.[16] Table 3 presents the results of the estimating equations both with and without additional controls. The first column of Table 3 presents the effect of the college share on the gross in-migration rate. As seen, there is a strong positive correlation between the in-migration rate and the share of adults with a college degree. The coefficient estimate of 0.522 suggests that increasing the college share by 0.1 increases the in-migration rate by 0.05. If, however, many of those who move to highly educated cities do so to pursue higher education, we would expect the share of adults with college degrees to be positively correlated with the out-migration rate as well. This is exactly what we find in the second column of Table 3.[17] Absent differences in fertility and mortality, an area grows if more people move to the area than leave the area.[18] Therefore, the effect of the share of adults with college degrees on the net migration rate tells us how human capital affects population growth. As seen in the third column, the correlation between the net migration rate and the college share is strongly positive. While the human capital level is correlated with both the extent to which people enter and leave a metropolitan area, on net metro population growth is increasing with the share of the adult population with a bachelor's degree or higher consistent with previous literature and the tabulations in Table 2.

As seen in the fourth, fifth, and sixth columns of Table 3, adding additional controls actually increases the coefficients on the human capital variable. The in-migration coefficient increases from 0.522 to 0.735, the out-migration coefficient increases from 0.310 to 0.435, and the net-migration coefficient increases from 0.212 to 0.300. The additional controls also appear to have an important effect on migration and growth. Population and median family income in 1990 appear to have a negative effect on in-migration, out-migration, and net migration, though the effect of family income on net migration is not

[15]Note that the top 20 percent do not necessarily constitute the entire set of smart cities. This grouping was made for illustration purposes only.

[16]Corresponding estimates for 1975–1980 and 1985–1990 are qualitatively similar and are available upon request.

[17]However, other hypotheses could also explain the high out-migration from high human capital cities.

[18]Fertility and mortality rates may also differ with the local human capital level, but I ignore such differences in this paper and instead focus on migration to and from high human capital cities.

TABLE 3: Migration to and from Metropolitan Areas, 1995–2000

	In	Out	Net	In	Out	Net
Share with bachelor's degree	0.522**	0.310**	0.212**	0.735**	0.435**	0.300**
	(0.066)	(0.043)	(0.039)	(0.089)	(0.057)	(0.063)
Population				−0.022**	−0.016**	−0.006**
				(0.004)	(0.003)	(0.002)
Median family income				−0.002*	−0.002**	−0.000
				(0.001)	(0.001)	(0.001)
Manufacturing share				−0.073	−0.109**	0.036
				(0.056)	(0.041)	(0.044)
January temperature				0.102*	0.005	0.097*
				(0.044)	(0.026)	(0.038)
July temperature				0.120	−0.063	0.183*
				(0.075)	(0.041)	(0.072)
Precipitation				0.032	−0.007	0.040
				(0.038)	(0.028)	(0.026)
Midwest				0.023**	0.015**	0.007
				(0.008)	(0.006)	(0.006)
South				0.017	0.016*	0.001
				(0.010)	(0.008)	(0.008)
West				0.038*	0.021	0.017
				(0.015)	(0.011)	(0.011)
Constant	0.086**	0.099**	−0.013	−0.029	0.205**	−0.234**
	(0.013)	(0.009)	(0.008)	(0.076)	(0.046)	(0.069)
R^2	0.21	0.17	0.09	0.49	0.45	0.29

Notes: All regressions contain 323 PMSA/MSA observations. Time-varying explanatory variables are measured as of 1990. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

significant. Increases in the average January daily low temperature increase both the in-migration rate and the net migration rate. Similarly, increases in average July daily high temperature have a significantly positive effect on net migration. Both are consistent with the ongoing movement of population in the United States from colder to warmer places. None of the remaining variables has a significant effect on net migration, though they do occasionally have a significant effect on in-migration or out-migration. Henceforth, I discuss only the results for the share of adults with a college degree. Results for the additional explanatory variables are available from the author upon request.

Migration by Enrollment in Higher Education

I next turn to the main regressions of this paper. In Table 4, I consider the effect of the human capital level on migration rates separately for persons enrolled in higher education and for persons not enrolled. If high human capital cities are growing in part because individuals move there to pursue higher education, then migration by those enrolled in higher education may constitute a disproportionately large share of the total in-migration to high human capital cities. Data limitations only allow us to know whether an individual is enrolled in the year of the sample (e.g., 2000), so these estimates may understate the role that migrating for higher education plays in the growth of smart cities. Measuring migration over a five-year period makes this especially possible as some people are likely to complete degrees in four years or less and stay in the metropolitan area after completing their degree. Also, migration rates in this section include only people age 16

TABLE 4: Migration by Enrollment in Higher Education

	Enrolled in Higher Education			Not Enrolled in Higher Education		
	In	Out	Net	In	Out	Net
A. 1995–2000						
Share with bachelor's degree	0.654**	0.080**	0.574**	0.075	0.349**	−0.274**
	(0.073)	(0.011)	(0.064)	(0.052)	(0.042)	(0.063)
Observations	323	323	323	323	323	323
R^2	0.59	0.47	0.55	0.35	0.48	0.30
B. 1985–1990						
Share with bachelor's degree	0.714**	0.090**	0.624**	0.182**	0.351**	−0.168*
	(0.076)	(0.010)	(0.071)	(0.067)	(0.047)	(0.080)
Observations	298	298	298	298	298	298
R^2	0.62	0.56	0.56	0.38	0.48	0.30
C. 1975–1980						
Share with bachelor's degree	0.916**	0.114**	0.802**	0.039	0.491**	−0.452**
	(0.096)	(0.020)	(0.087)	(0.128)	(0.098)	(0.084)
Observations	276	276	276	276	276	276
R^2	0.49	0.10	0.56	0.17	0.07	0.41

Notes: All regressions also contain additional controls for population, median family income, manufacturing share, January temperature, July temperature, precipitation, and region dummy variables with time-varying explanatory variables measured as of the previous decennial census. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

and over, though including persons under 16 in the not enrolled group does little to change the results.

The upper Panel A of Table 4 presents the regression results for migration by enrollment between 1995 and 2000. According to the results, the share of adults with at least a bachelor's degree has a strong positive correlation with the in-migration of persons enrolled in college. Thus, as expected, college students are moving to high human capital metropolitan areas in large numbers. The coefficient on the human capital level for those not enrolled, however, is small (though positive) and not statistically significant. Unlike students, persons not enrolled in college do not appear to be moving to smart cities in large numbers. This is an important result. People are moving in large numbers to high human capital metropolitan areas, but persons pursuing higher education represent the majority of such migrants. This is perhaps even more impressive given that persons enrolled in higher education represented only about 16 percent of all migrants age 16 and over between 1995 and 2000.

The results from Table 3 also suggested that high human capital cities have high rates of out-migration. Looking separately at out-migration rates by college enrollment tells us who is leaving smart cities. As seen in the second and fifth columns of Table 4, the human capital level in a metropolitan area significantly increases the out-migration of both those enrolled in higher education and those who are not. The effect, however, is much larger for those not enrolled.[19] These findings are consistent with the hypothesis that individuals move to high human capital cities for higher education, but often leave after completing their education. Also consistent with this hypothesis, the share of adults

[19]Similarly, separate analysis of out-migration by educational attainment (not shown) reveals that persons with a bachelor's degree or higher account for nearly all of the differential out-migration from smart cities.

who are college educated is positively correlated with the net migration rate of those enrolled, but negatively correlated with the net migration rate of those not enrolled. Importantly though, the net migration coefficient for the enrolled is larger in absolute value than the coefficient for those not enrolled. This suggests that many of the persons who move to smart cities for higher education stay in the city after their education is complete. As a result, smart cities are growing considerably faster than less skilled cities, and students moving for higher education and staying after their education is complete play an important role in the growth of smart cities.

To confirm that the results for 1995–2000 are not particular to the time period considered, Panels B and C of Table 4 replicate the results in Panel A using migration between 1985 and 1990 and 1975 and 1980, respectively. In Panel B, independent variables are measured as of 1980, and in Panel C, independent variables are measured as of 1970. The results for the human capital variable in Panels B and C are qualitatively similar to those in Panel A with one exception. For in-migration between 1985 and 1990, the coefficient for those not enrolled is statistically significant and larger than in the other years. The effect, however, is still smaller than the effect for those who are enrolled. Furthermore, "not enrolled" likely includes some persons who previously were enrolled and stayed in the city after completing their education. The results for 1975–1980 and 1985–1990, therefore, reaffirm the primary importance that students moving for higher education have played in the growth of high human capital cities.

Migration by Age Group

I next look at migration by five-year age groups between 1995 and 2000. Table 5 presents the results for the effect of the share of adults with a college degree on in-migration, out-migration, and net migration, but the regressions also contain the other variables included previously. The full results are available upon request. I discuss the main results from Table 5 only briefly. The coefficients in Table 5 are also illustrated graphically in Figure 1.

Evidence in the previous section suggests that individuals are moving to smart cities primarily for higher education. This suggests that the age distribution of persons moving to high human capital cities is likely to be skewed toward persons in their primary college-going years. Table 5 confirms this expectation. The effect of human capital on in-migration is largest for the 20–24 age group followed by the 15–19 and 24–29 age groups. This is also illustrated by the sharp peak in Figure 1 at the 20–24 age group. For older and younger age groups, the effect of human capital on in-migration is much smaller and even negative for some age groups.

Previous evidence also suggests that recent in-migrants often leave after completing their education. Thus, we might expect there to be higher rates of out-migration from high human capital metropolitan areas for persons in age groups for which people are likely to have recently completed a degree (or perhaps dropped out of school). The out-migration estimates in Table 5 and Figure 1 again confirm this hypothesis. The effect of human capital on out-migration is highest for persons in the 25–29 age group followed by persons in the 30–34 and 20–24 age groups.

The results in the third column of Table 5 suggest that on net high human capital cities are gaining workers in their peak college-going years (15–19 and 20–24) and losing workers who have recently finished their education (25–29 and 30–34), which is also nicely illustrated in Figure 1. However, the inflow of the younger cohorts exceeds the outflow of the older cohorts. Thus, looking at migration by age provides further evidence that smart cities are growing because some of the individuals who move for higher education stay in the city after completing their education. As suggested by Chen and Rosenthal (2008),

TABLE 5: Results of Human Capital Stock on Migration by Age Group, 1995–2000

	In	Out	Net
Age 5–9	0.004	0.005	−0.002
	(0.005)	(0.006)	(0.005)
Age 10–14	0.001	0.001	−0.000
	(0.004)	(0.004)	(0.005)
Age 15–19	0.167**	−0.007	0.173**
	(0.020)	(0.003)	(0.021)
Age 20–24	0.420**	0.064**	0.356**
	(0.050)	(0.012)	(0.040)
Age 25–29	0.105**	0.248**	−0.144**
	(0.010)	(0.033)	(0.029)
Age 30–34	0.039**	0.087**	−0.049**
	(0.007)	(0.009)	(0.010)
Age 35–39	0.017**	0.029**	−0.012
	(0.006)	(0.005)	(0.006)
Age 40–44	0.011*	0.013**	−0.002
	(0.005)	(0.004)	(0.005)
Age 45–49	0.013**	0.006*	0.006
	(0.005)	(0.003)	(0.005)
Age 50–54	0.003	0.006*	−0.003
	(0.005)	(0.002)	(0.005)
Age 55–59	−0.005	0.001	−0.007
	(0.005)	(0.002)	(0.005)
Age 60–64	−0.013*	−0.001	−0.011*
	(0.005)	(0.001)	(0.005)
Age 65–69	−0.012**	−0.004**	−0.008*
	(0.004)	(0.001)	(0.004)
Age 70–74	−0.007*	−0.004*	−0.003
	(0.003)	(0.002)	(0.002)
Age 75–79	−0.005*	−0.003*	−0.002
	(0.002)	(0.001)	(0.001)
Age 80–84	−0.001	−0.004**	0.003*
	(0.001)	(0.001)	(0.001)
Age 85+	−0.000	−0.004**	0.003*
	(0.001)	(0.001)	(0.001)

Notes: All regressions contain 323 PMSA/MSA observations and the additional explanatory variables included in Table 3. Time-varying explanatory variables are measured as of 1990. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

migration is likely to have important effects on the age distribution of cities. Smart cities that contain flagship universities are likely to have a regular supply of young highly educated workers to keep them relatively young.

Excluding "College Towns" and Smaller Cities

Given the high incidence of small metropolitan areas with flagship universities in Table 1, one might be concerned that the results thus far may be dominated by the effect of "college towns." College towns are generally thought to be small and mid-sized metropolitan areas that are dominated by the presence of a local college or university. Thus, two questions emerge. First, is the connection between human capital and population growth solely due to the growth of college towns? In other words, are smart cities other than

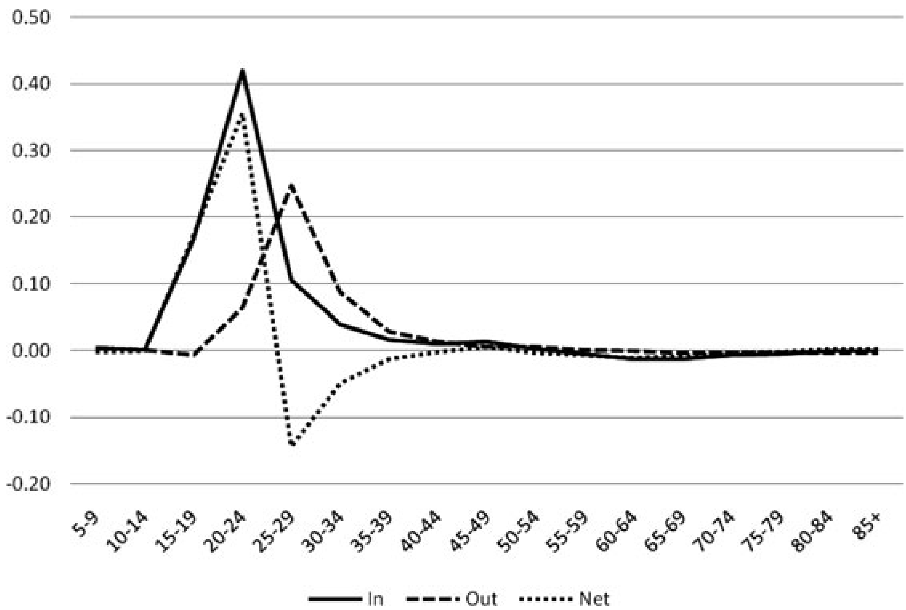

FIGURE 1: Human Capital Migration Coefficients by Age Group.

TABLE 6: Migration Rate Tabulations by "College Town" Status, 1995–2000

	In	Out	Net
Cities in the top 20% of college share that are not "college towns" ($N = 43$)	0.208	0.168	0.040
Cities in the top 20% of college share that are "college towns" ($N = 21$)	0.323	0.245	0.078

Note: A metro area is defined as a college town if its share of in-migrants age 18–24 is more than one standard deviation above the mean share of in-migrants age 18–24 across all metro areas.

college towns growing as well? Second, if noncollege town smart cities are growing as well, does student in-migration play an important role in their growth?

To answer these questions, I begin by identifying college towns based on a definition similar to that suggested by Plane and Heins (2003). I define a metropolitan area as a college town if the age profile of its in-migration flows is skewed toward persons age 18–24. More specifically, a metro area is defined as a college town if its share of in-migrants age 18–24 is more than one standard deviation above the mean share across all metro areas. This definition identifies 40 metro areas as college towns including all of the relatively small metropolitan areas surrounding major public universities included in Table 1.[20]

Evidence on the first question is offered by tabulating migration rates for the top 20 percent of metropolitan areas by the share of college graduates separately for college towns and noncollege towns. These tabulations are presented in Table 6. The tabulations suggest that for the top 20 percent of cities, college town have higher rates of net migration (0.078) and are hence growing faster than noncollege towns (0.040). However, comparing Table 6 to Table 2, noncollege towns in the top 20 percent of human capital still have higher rates of net migration than metropolitan areas outside of the top 20 percent of human capital. In other words, the connection between the local human capital stock and

[20]The results to follow are generally robust to expanding the definition of college towns to be more inclusive.

TABLE 7: Robustness to Excluding College Towns and Smaller Cities, 1995–2000

	Enrolled in Higher Education			Not Enrolled in Higher Education		
	In	Out	Net	In	Out	Net
A. Excluding "College Towns"						
Share with bachelor's degree	0.202**	0.040**	0.162**	0.162*	0.170**	−0.009
	(0.025)	(0.007)	(0.025)	(0.076)	(0.038)	(0.072)
Observations	283	283	283	283	283	283
R^2	0.39	0.35	0.24	0.38	0.36	0.26
B. Larger Cities Only (MSA Population >500,000)						
Share with bachelor's degree	0.199**	0.030**	0.169**	0.158	0.148**	0.010
	(0.037)	(0.009)	(0.035)	(0.176)	(0.043)	(0.160)
Observations	92	92	92	92	92	92
R^2	0.48	0.53	0.40	0.51	0.56	0.40

Notes: All regressions also contain additional controls for population, median family income, manufacturing share, January temperature, July temperature, precipitation, and region dummy variables with time-varying explanatory variables measured as of the previous decennial census. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

population growth is not solely due to the growth of college towns, though the influence of college towns is important.

To answer the second question, we return to the regression analysis. Panel A of Table 7 reproduces the regressions in Panel A of Table 4, in which migration equations are estimated separately for those enrolled in higher education and those who are not, but excludes the 40 college towns from the analysis. The human capital coefficient is positive and significant in the in-migration equations for both those enrolled and those not enrolled. The coefficient, however, is larger for those enrolled, suggesting that student migrants still account for the majority of the relationship between human capital and in-migration even after college towns are excluded from the analysis. Additionally, even after excluding college towns, the coefficient for human capital in the net migration equation is positive and significant for those enrolled, and significantly larger in absolute value than the coefficient for those not enrolled. This again suggests that smart cities are growing even after excluding college towns.

As a further test of the robustness of the analysis, I also estimate the migration equations including only metro areas with a 1990 population of at least 500,000 people, since larger cities are unlikely to be considered college towns.[21] The results are presented in Panel B of Table 7. Similar to previous results, the majority of the effect of human capital on in-migration is due to those enrolled in college. Thus, even for relatively large metropolitan areas migration for college appears to play an important role in the connection between human capital and population growth.

Note also that the sum of the net migration coefficients in Panel B of Table 7 is significantly smaller than the sum of the net migration coefficients for the full sample. Thus, larger smart cities are not growing as fast as their smaller counterparts. This likely results in part because a number of larger smart cities, such as San Francisco and Boston, have a relatively inelastic supply of housing. Thus, instead of growing in population, these areas experience increases in housing prices (Gyourko et al., 2006).

[21]The results are qualitatively robust to using a different population cutoff to define larger cities.

TABLE 8: Migration by Previous Residence, 1995–2000

	Same State			Different State or Country		
	In	Out	Net	In	Out	Net
Share with bachelor's degree	0.460**	0.225**	0.236**	0.275**	0.210**	0.065
	(0.083)	(0.054)	(0.049)	(0.073)	(0.047)	(0.056)
R^2	0.35	0.29	0.23	0.29	0.31	0.27

Notes: All regressions contain 323 PMSA/MSA observations and the additional explanatory variables included in Table 3. Time-varying explanatory variables are measured as of 1990. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

Migration by Previous Residence

I next examine whether smart cities are growing by gaining migrants from other states and countries or by gaining migrants from within the same state. We might expect much of the migration to smart cities to come from within the same state since smart cities often contain large state universities that get a large share of their enrollment from within the state. In Table 8, I estimate the effect of the human capital level in a metropolitan area on migration separately for persons who moved from within the same state and for persons who did not.[22] The results in the first and fourth columns suggest that roughly 63 percent of the differential gross in-migration to high human capital cities is from persons within the same state. The remaining portion results from persons moving from other states and other counties. The results in the second and fifth columns, however, suggest that high human capital cities lose about as many people to other areas within the same state as they do to areas outside of the state. As a result, the effect of the local human capital stock on positive net migration is largely attributable to persons moving from within the same state as shown in the third and sixth columns. According to the estimates, within state moves account for more than 78 percent of the effect of the human capital stock on total net migration, and we cannot reject the hypothesis that net migration from areas outside the state is unaffected by the local human capital level. Importantly, this suggests that population growth in high human capital cities may not result in population growth at the state level. Similarly, Burtless (2004) shows that the strong positive correlation between the human capital stock and future population growth found across metropolitan areas does not hold at the state level, at least for the period from 1990 through 2000. His estimates suggest that the share of college educated adults in a state has virtually no effect on future population growth in the state.

These findings have important implications for policy makers. High human capital cities are growing primarily by gaining young people pursuing higher education from other areas within the same state. Thus, the growth of smart cities partially involves an intrastate "brain drain" from areas without higher education institutions to areas with higher education institutions. Over time, this can have important effects in redistributing skilled workers within a state. If the current pattern continues to hold, areas with a comparative advantage in higher education will continue to thrive while areas that offer little higher education opportunities are likely to be less successful.

[22]For metropolitan areas that crossed state boundaries, I considered the move to be within state if the portion of the metropolitan area in which the individual lived was in the same state as that in which they moved to or from. For example, a person moving from Topeka, Kansas to Kansas City, Kansas would be classified as an in-state mover. However, someone moving from Topeka to Kansas City, Missouri would be classified as an interstate mover, even though Kansas City, Kansas and Kansas City, Missouri are in the same metropolitan area. The same holds for out-migration as well.

TABLE 9: Migration of U.S. Born by Enrollment, 1995–2000

	Enrolled in Higher Education			Not Enrolled in Higher Education		
	In	Out	Net	In	Out	Net
Share with bachelor's degree	0.579**	0.069**	0.510**	0.056	0.307**	−0.251**
	(0.065)	(0.010)	(0.057)	(0.047)	(0.039)	(0.055)
R^2	0.59	0.48	0.55	0.33	0.50	0.26

Notes: All regressions contain 323 PMSA/MSA observations and the additional explanatory variables included in Table 3. Time-varying explanatory variables are measured as of 1990. Huber–White robust standard errors in parentheses.

*Significant at 5 percent level; **Significant at 1 percent level.

Migration by U.S. Born as a Robustness Check

One concern discussed above is that we do not observe people who leave the country. If large numbers of students come to the United States for higher education and then leave once their education is complete, my estimates will overstate the growth effects of human capital and will overattribute growth to persons moving for higher education. To see if this is driving the results, I reestimate the migration by enrollment equations for the 1995–2000 period including only persons born in the United States The results are reported in Table 9. Comparing the results to Panel A of Table 4, the coefficients on the share of adults with a college degree decrease slightly in all columns, but the results are qualitatively the same. The bulk of those moving to smart cities are enrolled in college, the bulk of those leaving smart cities are not, and smart cities gain more people than they lose causing them to grow.

Increased Enrollment as an Alternative Explanation

The evidence thus far has been interpreted to suggest that smart cities are growing because many of the people who move to high human capital cities to pursue higher education end up staying in the city after their education is complete. An alternative explanation that could also be consistent with the evidence in previous sections is that high human capital cities are growing because they have experienced larger increases in enrollment (and hence higher rates of in-migration) in higher education than low human capital cities. In other words, increased enrollment could cause population growth even if all students leave the area after completing their education. To examine this possibility, I look at changes in the number of people in a metropolitan area by college enrollment between 1990 and 2000 using data from the U.S. Counties database (U.S. Department of Commerce, Bureau of the Census, 2008) with metropolitan areas now measured as New England County Metropolitan Areas (NECMA) in New England and Primary Metropolitan Statistical Areas/Metropolitan Statistical Areas (PMSA/MSA) outside of New England according to 1999 metropolitan area definitions. More specifically, I estimate

$$(Pop_{enr,j,t+1} - Pop_{enr,j,t})/Pop_{j,t} = \beta_{enr} S_{j,t} + \Gamma_{enr} \mathbf{Z}_{j,t} + \varepsilon_{enr,j}, \quad (4)$$

and

$$(Pop_{not,j,t+1} - Pop_{not,j,t})/Pop_{j,t} = \beta_{not} S_{j,t} + \Gamma_{not} \mathbf{Z}_{j,t} + \varepsilon_{not,j}, \quad (5)$$

where $Pop_{enr\,j,t+1}$ is the number of people in metropolitan area j enrolled in higher education in time $t + 1$, $Pop_{not\,j,t+1}$ is the number of people in metropolitan area j not enrolled in higher education in time $t + 1$, $Pop_{j,t}$ is the total population in metropolitan area j in time t, and $\mathbf{Z}$ is the vector of additional explanatory variables included previously.

TABLE 10: Population Growth by Enrollment in Higher Education, 1990–2000

	Enrolled	Not Enrolled
Share with bachelor's degree	0.097**	0.302*
	(0.022)	(0.127)
R^2	0.29	0.38

Notes: All regressions contain 318 NECMA/PMSA/MSA observations and the additional explanatory variables in Table 3. Time-varying explanatory variables are measured as of 1990. Huber–White robust standard errors in parentheses. See text for details on computation of population growth by enrollment.

*Significant at 5 percent level; **Significant at 1 percent level.

The total effect of the human capital stock on population growth is equal to the sum of β_{enr} and β_{not} in (4) and (5). If the growth of high human capital cities is entirely due to increases in enrollment without at least some student in-migrants staying after completing their education, then β_{not} should equal zero. The results from (4) and (5) are reported in Table 10. The results suggest that high human capital metropolitan areas experience larger increases in the numbers of both enrolled persons and nonenrolled persons than low human capital metropolitan areas. More than 75 percent of the total effect, however, is attributable to changes in the number of people not enrolled.[23] Thus, while the growth of smart cities is partially attributable to greater increases in enrollment in smart cities, the bulk of the growth of smart cities is not. The largest source of population growth for smart cities appears to be that a large number of persons move to high human capital cities for higher education and then stay in the city after their education is complete.

6. CONCLUSION

This paper examines why smart cities are growing by examining who moves to smart cities. Because smart cities are often centers of higher education, persons moving to pursue higher education are hypothesized to play an important role in the growth of smart cities. In support of this hypothesis, I find that the relationship between human capital and in-migration is mostly attributable to persons enrolled in higher education.

Upon completing their education, many recent in-migrants leave the city to move back to a previous location or on to a new location. Many recent in-migrants, however, stay in the city after their education is complete. Recently acquired connections to employers and friends and tastes for local amenities cause the city they are in to offer a higher level of utility than alternative locations. The high rate of recent graduates staying causes smart cities to grow faster than low human capital cities.

Evidence also suggests that smart cities are growing primarily by gaining young people pursuing education from other areas within the same state and not from areas outside the state. The growth of smart cities, therefore, largely involves an intrastate brain drain from areas without higher education opportunities to areas with higher education opportunities.

[23]Note, however, that the total effect of the college share on population growth in Table 10 (0.399) is less than twice the effect of the college share on net migration in the last column of Table 3 (0.300). This may partially result from much larger coefficients on amenities and region dummies for the regression in the second column of Table 10 suggesting that amenities may have played a greater role in population growth between 1990 and 1995. When the regressions in Table 10 are estimated with only the college share as an explanatory variable, the total effect (0.400) is roughly twice that of the coefficient for net migration in the third column of Table 3. Also, the share of population growth attributed to increased enrollment falls to less than 12 percent when only the college share is included as an explanatory variable.

REFERENCES

Adams, James D. 2002. “Comparative Localization of Academic and Industrial Spillovers,” *Journal of Economic Geography*, 2, 253–278.

Alm, James and John V. Winters. 2009. “Distance and Intrastate College Student Migration,” *Economics of Education Review*, 28, 728–738.

Audretsch, David B. and Maryann P. Feldman. 1996. “R&D Spillovers and the Geography of Innovation and Production,” *American Economic Review*, 86, 630–640.

Berry, Christopher R. and Edward L. Glaeser. 2005. “The Divergence of Human Capital Levels across Cities,” *Papers in Regional Science*, 84, 407–444.

Black, Duncan and Vernon Henderson. 1999. “A Theory of Urban Growth,” *Journal of Political Economy*, 107, 252–284.

Blackwell, Melanie, Steven Cobb, and David Weinberg. 2002. “The Economic Impact of Educational Institutions: Issues and Methodology,” *Economic Development Quarterly*, 16, 88–95.

Burtless, Gary. 2004. “Comment on The Rise of the Skilled City,” *Brookings-Wharton Papers on Urban Affairs*, 95–99.

Chen, Yong and Stuart S. Rosenthal. 2008. “Local Amenities and Life-Cycle Migration: Do People Move for Jobs or Fun?” *Journal of Urban Economics*, 64, 519–537.

Clark, David E. and William J. Hunter. 1992. “The Impact of Economic Opportunity, Amenities, and Fiscal Factors on Age-Specific Migration,” *Journal of Regional Science*, 32, 349–365.

Conway, Karen S. and Jonathan C. Rork. 2006. “State Death Taxes and Elderly Migration-The Chicken or the Egg?” *National Tax Journal*, 59, 97–128.

DaVanzo, Julie. 1983. “Repeat Migration in the United States: Who Moves Back and Who Moves On?” *Review of Economics and Statistics*, 65, 552–559.

De la Garza, Adrián G. 2008. “Do Smart Cities Grow Faster?” *Ensayos Revista de Economía*, 27, 1–28.

Drucker, Joshua and Harvey Goldstein. 2007. “Assessing the Regional Impacts of Universities: A Review of Current Approaches,” *International Regional Science Review*, 30, 20–46.

Florida, Richard. 2002. “Bohemia and Economic Geography,” *Journal of Economic Geography*, 2, 55–71.

Franklin, Rachel S. 2003. *Migration of the Young, Single and College Educated: 1995 to 2000.* Census 2000 Special Reports, CENSR-12. Washington, DC: U.S. Government Printing Office.

Glaeser, Edward L. and Albert Saiz. 2004. “The Rise of the Skilled City,” *Brookings-Wharton Papers on Urban Affairs*, 47–94.

Glaeser, Edward L., Jose A. Scheinkman, and Andrei Shleifer. 1995. “Economic Growth in a Cross-Section of Cities,” *Journal of Monetary Economics*, 36, 117–143.

Glaeser, Edward L. and Jesse M. Shapiro. 2003. “Urban Growth in the 1990s: Is City Living Back?” *Journal of Regional Science*, 43, 139–165.

Groen, Jeffrey A. 2004. “The Effect of College Location on Migration of College-Educated Labor,” *Journal of Econometrics*, 121, 125–142.

Groen, Jeffrey A. and Michelle J. White. 2004. “In-State versus Out-of-State Students: The Divergence of Interest between Public Universities and State Governments,” *Journal of Public Economics*, 88, 1793–1814.

Gyourko, Joseph, Chistopher Mayer, and Todd Sinai. 2006. “Superstar Cities,” NBER Working Paper, 12355.

Henderson, J. Vernon. 2007. “Understanding Knowledge Spillovers,” *Regional Science and Urban Economics*, 37, 497–508.

Hickman, Daniel C. 2009. “The Effects of Higher Education Policy on the Location Decision of Individuals: Evidence from Florida’s Bright Futures Scholarship Program.” *Regional Science and Urban Economics*, 39, 553–562.

Huffman, David and John M. Quigley. 2002. “The Role of the University in Attracting High Tech Entrepreneurship: A Silicon Valley Tale,” *Annals of Regional Science*, 36, 403–419.

Jaffe, Adam B. 1989. “Real Effects of Academic Research,” *American Economic Review*, 79, 957–970.

Jaffe, Adam B., M Trajtenberg, and R Henderson. 1993. “Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations,” *Quarterly Journal of Economics*, 108, 577–598.

Krupka, Douglas J. 2009. “Location-Specific Human Capital, Location Choice and Amenity Demand,” *Journal of Regional Science*, 49, 833–854.

Krupka, Douglas J. and William J. Smith. 2008. “Amenities, Migration, and Location-Specific Human Capital,” Working Paper.

Lange, Fabian, and Robert Topel. 2006. “The Social Value of Education and Human Capital,” in Eric Hanushek and Finis Welch (eds.), *Handbook of the Economics of Education*. Amsterdam: Elsevier.

Moretti, Enrico. 2004a. “Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data,” *Journal of Econometrics*, 121, 175–212.

——. 2004b. “Human Capital Externalities in Cities,” in J. Vernon Henderson and Jacques-Franois Thisse (eds.), *Handbook of Regional and Urban Economics*. Amsterdam: Elsevier.

Plane, David A. and Frank Heins. 2003. “Age Articulation of U.S. Inter-Metropolitan Migration Flows.” *Annals of Regional Science*, 37: 107–130.

Plane, David A. and Jason R. Jurjevich. 2009. “Ties That No Longer Bind? The Patterns and Repercussions of Age-Articulated Migration,” *Professional Geographer*, 61: 4–20.

Rauch, James E. 1993. “Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities,” *Journal of Urban Economics*, 34, 380–400.

Ruggles, Steven, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King, and Chad Ronnander. 2008. *Integrated Public Use Microdata Series: Version 4.0 [Machine-Readable Database]*. Minneapolis, MN: Minnesota Population Center [Producer and Distributor].

Shapiro, Jesse M. 2006. “Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital,” *Review of Economics and Statistics*, 88, 324–335.

Simon, Curtis J. 1998. “Human Capital and Metropolitan Employment Growth,” *Journal of Urban Economics*, 43, 223–243.

——. 2004. “Industrial Reallocation across U.S. Cities, 1977–97,” *Journal of Urban Economics*, 56, 119–143.

Simon, Curtis J. and Clark Nardinelli. 2002. “Human Capital and the Rise of American Cities, 1900–1990,” *Regional Science and Urban Economics*, 32, 59–96.

Sjaastad, Larry A. 1962. “The Costs and Returns of Human Migration,” *Journal of Political Economy*, 70, 80–93.

U.S. Department of Commerce, Bureau of the Census. 1972. *County and City Data Book Consolidated File: County Data, 1947–1977, ICPSR Version*. Washington, DC: U.S. Bureau of the Census [Producer], Ann Arbor, MI: Inter-University Consortium for Political and Social Research [Distributor], 2008–04-01.

——. 1988. *County and City Data Book 1988*. Washington, DC: U.S. Bureau of the Census.

——. 2000. *County and City Data Book 2000*. Washington, DC: U.S. Bureau of the Census.

——. 2007. *County and City Data Book 2007*. Washington, DC: U.S. Bureau of the Census.

——. 2008. *USA Counties*, http://www.census.gov/support/DataDownload.htm/, Accessed August 7, 2008.

U.S. Department of Housing and Urban Development. 2008. *State of the Cities Data System*, http://socds.huduser.org/, Accessed September 7, 2008.