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Measures beyond the College Degree Share to Guide Inter-regional Comparisons and Workforce Development

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Raising the share of adults with college degrees in a region or jurisdiction is a nearly universal goal of regional policy makers. They believe that education, as summarized by this statistic, is the cause of increasing employment, productivity, and wages. Using statistics estimated from the decennial censuses and the American Community Survey, this analysis demonstrates how different measures would suggest different rankings of more successful versus less successful metro areas. The “place-of-birth” variable in Census data enables a disaggregation of the origins of the skilled and unskilled adult populations. This provides insight into whether high-skilled regions developed talent among natives or attracted talent nationally or globally. I find that metros in states that are successful at getting their natives through college have experienced lower growth in their native and migrant graduate populations. With a few exceptions, metro areas with high degree shares or large improvements in their degree share have not grown their graduate population at unusually high rates. The numbers suggest that metro areas held up as exemplars of educational attainment have achieved this distinction to a large extent by being unattractive to nongraduates.

Keywords: College degree share, regional development policy, migration.

JEL Codes: I25, J24, J61, R23.

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1 Introduction

One of the dominant themes of regional economic development discussions revolves around increasing the percentage of an area's adults who hold college degrees. The college degree share is highly correlated with most important measures of regional success. Economists have linked college attainment in a metro area to outcomes such as productivity, income, employment, patents, and new firm start-ups. The degree share is simple and readily available. For many public officials, the positive impact on economic development is a given, so raising the percentage becomes the goal itself. A niche industry of consultants produces reports for local governments and chambers of commerce that explain how the client's area can become like the highly-educated Silicon Valley and Research Triangle. The processes behind increasing the college degree share is something policy makers want to understand better.

The identification of successful regions, whose policies might be emulated, is highly dependent on the measure selected. In section 3, I present two measures of the levels and three measures of the increase in metro areas' skilled workforce. They demonstrate that picking "winners" is highly dependent on the measure used. In section 4, I propose a measure that uses a historical baseline and disaggregates the skilled and unskilled workers by their place of birth. Using both the common and the novel measures, section 5 explores how metro areas have assembled the workforces they currently employ. The analysis reveals that while educating the people born in a state is associated with higher degree shares in the state's metro areas, the path may be indirect or possibly not causal. States that are successful at educating their natives neither retain especially high shares of those natives, nor attract especially high numbers of educated migrants. Rather, the metros of states that get more of their natives through college are distinguished by very low levels of retention or attraction of unskilled workers.

1.1 Literature

A large economic literature attempts to explain the variation of employment growth, productivity, and wages between metropolitan areas. Wages for all workers are generally higher in metros with larger populations. Economists believe these wage differences must reflect productivity differences because if they did not, a firm in a high wage area could move its operations to a metro with lower wages and equal productivity. There are several theories regarding why more populous regions produce additional economic benefits, called agglomeration economies, for their residents. In the industrial era, gathering into a city lowered the cost of transporting raw material and finished goods. As the US economy has transitioned to reliance on knowledge and ideas, these may be transferred more efficiently when people meet face to face. The higher productivity could result from workers within an industry learning from competing firms, or inspiring productivity enhancing innovations in one another. New workers could learn more quickly due to increased contacts with experienced people in their field. Some economists have highlighted the concentrations of industries that allow them to share workers, suppliers, customers, and knowledge. Urbanists such as Jane Jacobs have stressed the interaction of diverse people and businesses creating new ideas and thus growth (1969). Glaeser and Gottlieb provide an extensive survey of the literature on agglomeration economies (2009).

At least two empirical studies link the college degree share with growth in employment. Gottlieb and Fogarty demonstrated that the college degree share in metropolitan areas predicted subsequent growth of per capita income and employment (2003). Shapiro estimated that between 1940 and 1990, a 10 percent increase in a metro's concentration of skilled workers led to a 0.8 percent increase in employment growth (2006). He also estimates that 60 percent of this additional employment growth is associated with increases in productivity, while the remainder is attributable to increases in local amenities. The amenities he assesses are the bars and restaurants that multiply with a growing market of upper income professionals.

The benefits of agglomeration are not uniformly distributed. Bacolod, Blum and Strange estimate a hedonic price model for worker skills and find that cognitive skills are more richly rewarded in larger cities (2009). A different isolation of the agglomeration phenomenon is undertaken by Glaeser and Resseger (2010). They break up the distribution of metro areas into high and low skilled, as defined by a degree share ranking, and demonstrate that wages rise with agglomeration in the high skill regions, but there is no relationship between population and wages for low-skilled cities. Bauer, Schweitzer and Shane estimate a state-level growth model in which the college degree share partially explains the lack of convergence in state incomes (2012). Several other factors are included in the model, such as taxes, climate and infrastructure, but the two outstanding factors are college attainment and patents.

Two papers co-authored by Glaeser have explicitly brought housing costs into the discussion. In Berry and Glaeser's paper, they document that in the 1970s and 1980s, both skilled and unskilled workers had higher wages if they were in an area with a higher degree share (Berry and Glaeser, 2005). However, by 2000, low skilled workers' advantage from working in a high-skilled region had fallen while the college graduates' wage advantage rose. If the cost of living is higher in these high-skilled cities, it would not be surprising if unskilled people decide they can improve their quality of life by moving to a less expensive area. Unskilled people from outside these regions would see the same mismatch, and they would opt to stay away. Berry and Glaeser do not find evidence that housing prices mattered before 2000, but this certainly needs to be revisited with data from the housing boom era. In a subsequent paper, Gleaser and Tobio look at the trends in the Sunbelt, where most fast growing cities are found (2008). They find that productivity gains in the Sunbelt have not greatly outpaced the nation's since 1980, and demand for the amenity of warm weather has also been unchanged. They explain the continued rapid population growth in the South as a response to large increases in the supply of housing.

2 Data

The data used in this analysis are the Decennial Census of 1980 and the pooled 2006 to 2010 American Community Surveys (ACS). I will refer to the observations from the ACS as 2010 data. Using the pooled data increases the sample sizes and provides more precise estimates, especially for smaller metro areas. One draw back of the pooled data is that any time trends that continued from 2006 to 2010 will cause the estimates of the value to be higher or lower than the true value in 2010. This happens because the earlier data is drawn from a somewhat different distribution. Both the Decennial Census and ACS data were obtained from the Minnesota Population Data Center.[1]

I limit the analysis to working-age adults. I exclude people younger than 25 because many of them are still finishing their undergraduate degrees. I also do not include people who are 65 or over and neither working nor looking for work. I assume these people are retired and unlikely to reenter the labor force. People with college degrees and higher lifetime earnings can afford to move to retirement destinations more often than unskilled workers. Including these retirees in the calculations would overstate the education levels of the workforce available in metro areas that are retirement destinations.

The definitions of metro areas have changed in many cases as the Census Bureau added exurban counties that were developed. These counties were not included in 1980 because their populations were small and few of their workers were commuting into the metro area. The addition of these counties' populations into the MSAs is a source of growth, along with migration and natural increase. In rare instances, a county was removed from one MSA and associated with another. For example, Monroe County Michigan was shifted from the Toledo MSA to the Detroit MSA, which had a substantial impact on the population counts for the Toledo area.

[1]Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. *Integrated Public Use Microdata Series: Version 5.0* [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

3 Interregional Comparisons with Various Measures

As mentioned above, regional economic development conversations are heavily focused on the college degree share. Why not focus on the equally available, understandable, and simple total population of college graduates? Figure 1 illustrates why this is generally a conversation killer. The league is not competitive. If total population of college graduates determines success or failure, and no one can suggest a plausible scenario under which Indianapolis catches up to Philadelphia or Los Angeles, then there is nothing to discuss. Figure 2 displays the preferred degree share measure which provides the exciting horse race. Small metropolitan areas such as Raleigh and Omaha can rival Boston and New York. Equally as important, the measures of outcomes are generally expressed in per capita terms, such as per capita income. If the desired outcomes were expressed in per capita terms and the educated population was expressed in levels, the positive correlations would be much weaker.

In the academic economics literature, the log of the population is often used. This transforms the skewed population counts to a close-to-normal distribution in log points. Relationships between logged values are interpreted as elasticities, or the percentage change in the dependent variable given a one percent change in the independent variable. These are somewhat harder to convey to policy makers and the public. While we cannot imagine the mayor of a city discussing why the city's college graduate population is 0.15 log points lower than that of comparable cities, log points do have the advantage of being a level, rather than a ratio.

The problem with ratios in empirical estimation is that they ascribe causality to both the numerator and denominator. For example, someone might argue that wages and productivity are higher in San Jose because its degrees share (0.47) is higher than that of St. Louis (0.32). Both metros have approximately 480,000 college graduates. However, St. Louis is home to approximately 1,000,000 non-graduates, while San Jose only has 526,000. Part of the correlation between the degree share and aggregate economic outcomes could be a measurement issue. If graduates are equally productive in both places, but their wages, productivity or income are averaged with that of less-productive non-graduates, the analysis could incorrectly conclude that a higher ratio causes higher productivity. Such an analysis would be observing the difference in productivity between workers with different levels of education, and drawing an erroneous conclusion about agglomeration economies. If the analysis was disaggregated into observations on graduates and non-graduates, and it observed higher productivity conditional on the individual's education level, then this might be evidence of positive externalities created in a region with higher attainment ratios. Why should the ratio, rather than the level matter? The theory of agglomeration must explain why the presence of non-graduates inhibit the channels that boost productivity. Do non-graduates interrupt the transmission of ideas between graduates? Do they preclude the sharing of customers, suppliers and expertise? Or are non-graduates just a proxy for an industrial structure weighted toward lower productivity enterprizes, such as tourism or low-tech manufacturing?

Turning to measures of the improvement in educational attainment, we find that the metro areas that are home to the largest collections of college graduates are also the ones that added the most college graduates over the last three decades. Table 1 displays the differences in the college graduate populations between 1980 and 2010. The total increase in college graduates very closely follows the ranking of initial population. Between 1980 and 2010, the sixteen metropolitan areas that added over 350,000 college graduates were all among the twenty largest metros in 1980. By the measure of total graduates added, some of the smaller cities that host the state capital, flag ship state university, or both are relatively small. Chicago's increase in college graduates was over twelve times larger than that of Ann Arbor or Madison.

The most frequently reported growth metric is the difference between the current college degree share and the college degree share at some point in the past, as in table 2. By this ranking, Boston, San Jose, and Baltimore stand out. There are also some metros with surprisingly high finishes, such as #8 Pittsburgh and #10 Birmingham. In this ranking,

#82 Ann Arbor, #55 Austin, and #48 Denver preform relatively poorly.

Table 3 presents a third growth measure in which the college graduate population in 2010 is divided by the college graduate population in 1980. This measure strongly favors the fast growing places. The top twenty metros are all in the South or West. Several of the large coastal cities are in the bottom half of this ranking, including #77 San Francisco, #76 New York, #64 San Jose, #56 Baltimore, and #54 Washington, DC. Pittsburgh, which finished eighth in the previous ranking (table 2) by improving its college degree share by 16.5 points is now down at #87 because it has only 2.15 graduates in 2010 for each graduate in 1980.

The preceding lists illustrate that assessing relative progress in raising educational attainment in a region's workforce is very sensitive to the measure chosen. In fact, the disagreement between the measures raises a new set of questions. How are some metro areas raising their degree share without unusually high increases in their population of graduates?

4 An alternative: the origin-growth measure

From the discussion in section 3, it is evident that different simple summaries statistics give very different perspectives on the development of skill workforces. In the following analysis, I introduce a measure which has important advantages over the preceding options. I present the figures as the number of graduates per 100 adults in the metro area in 1980. I will refer to this measure as the origin-growth measure because it reflects the birth place (origin) of the workers of various types and the growth in their subpopulations over three decades. This measure has two distinct advantages.

First, scaling by the population in 1980 adjusts for the metro area's size without combining the impacts of recent increases in skilled and non-skilled workers. Using the current population to scale the number gives a point-in-time measure, with no information about trends. Using a historical population to scale the data enables the measure to reflect growth in each subpopulation since the base year. This measure using the historical baseline does not mask fast (slow) growth in one category behind fast (slow) growth in another category. Such masking can happen with the commonly-reported degree share because it is a purely relative measure. For example, the degree share for Bakersfield, CA, has only risen 1.5 points since 1980, which might mislead people into thinking there are few additional college graduates there. Bakersfield's college graduate population has risen 140 percent, but this is obscured by the 112 percent increase in their non-degreed population. Bakersfield's 2010 college graduate population equals 32 percent of the 1980 total working age population while its non-graduates equal 184 percent of the 1980 total.

A second advantage of the origin-growth measure is that it reflects that long term strategies led to the creation or attraction of the skilled work force. Using the metro's population of adults from 30 years ago reflects that building a skilled workforce is a decades-long endeavor. Each metro's adults in 1980 had to look ahead to the emerging information economy and make numerous decisions. Did they stay or relocate? Did they pursue a degree themselves? How many children did they have and how much did they invest in the children's education? Did they support higher education and research funding? Did they create a tax and regulatory climate that was attractive to businesses? Did they enact policies that raised the cost of living or kept it low? Did they invest in amenities? The measure that I report, workers per 100 adults in 1980, reflects the change in the local population that is the result of these decisions.

The choice of year is arbitrary, but a historical baseline is essential. I prefer 1980 as a baseline year because it is approximately the time when it became clear that manufacturing employment would no longer be growing. In the 1960s and 1970s, industrial production was shifting from the North to the South, while from the 1980s onward, manufacturing employment primarily grew in companies' offshore operations. After 1980, the information technology industry began to develop, and employment growth accelerated in services such as finance. This was the era when metro areas transitioned to the post-industrial economy and when the college degree share became the defining characteristic of a region.

Reporting growth of skilled workers relative to the the population of skilled workers in a prior year also can be misleading. Metros starting with a small base can post very high growth rates by adding small populations of graduates. Also, every subpopulation will have a different denominator. Scaling the current sub-populations to the baseline total population enables one to see the size of the skilled and unskilled workforces on the same scale within each metro, namely the percent of the 1980 total. For example, if someone said that Nashville's college graduate population has grown by 245 percent since 1980 and its non-graduate population has grown by 60 percent, it seems like Nashville is headed for the top of the charts. The smaller base of college graduates in 1980 makes the graduate growth appear very large. Dividing the 2008 populations by the 1980 total reveals that the current graduate population is 64 percent of the 1980 total and the non-graduate population is 131 percent of the 1980 total. This reflects the growth in the populations but keeps in perspective that there are still more non-graduates than graduates.

In highly educated places, such as Ann Arbor, MI, the graduate and non-graduate measures will be similar. In Ann Arbor, the graduates in 2008 are 105 percent of the 1980 population and the non-graduates are 121 percent of the 1980 population. In most places, where college degree holders are one sixth to one third of the population, the non-degree measure will be much larger than the degree-holder measure (as in Bakersfield and Nashville). If both figures are high (i.e. Boise 109 & 245), it means the metro area's population has grown by a large percentage since 1980; if both figures are small (i.e. Buffalo 31 & 71), the metro has been a slow-growing place.

Sorting out the origins of the skilled workers in a region is done far less often than calculating their share. Most data sets are focused on current circumstances, so they only record the respondent's residence at the time of the survey. Throughout this analysis, I will make use of the recording of respondents' "place of birth" in the American Community Survey (ACS).

The counts of "native graduates" and "native non-graduates" include people who are observed living in the state in which they were born. For MSAs that cross state boundaries, individuals are counted as natives if they have moved to another state but remain within the multistate MSA. For example, someone born in New York State and currently living in the New Jersey portion of the New York City MSA is counted as a native. Likewise, someone born in Maryland and currently living in the Virginia portion of the Washington, DC, MSA is counted as a native.

How do the metros compare on these measures? Figures 4 and 5 present the measures for the 100 largest metros. They are ranked by the 2010 college degree share. Looking at the top twenty metros, we see considerable variation. Ann Arbor, Raleigh and Austin have collected state-native graduates, while Denver and Colorado Springs have not. Raleigh, Austin, Atlanta and Colorado Springs all have exceptionally large populations of domestic migrant graduates relative to their 1980 populations. The representation of foreign degree holders in the top twenty cities is not extremely high relative to the national average, with the exception of San Jose. Perhaps the only generalization that can be drawn is that there are many paths to reaching the goal of high college attainment rates for a metro workforce.

5 The relative importance of education versus attraction of graduates

5.1 Origin growth measures by quintiles

Regional leaders can not change the education levels their region starts with, but they are seeking policies to influence how quickly those levels increase. With the educate-vs-attract question in mind, I sort the metro areas by their degree shares and two measures of education growth and then examine their workforces. To describe the whole the distribution, I divide the 239 metro areas into quintiles by degree attainment, and I average the MSAs' figures while weighting them by their 2010 population.

For someone who thought that local investments in education created the smart cities, figure 6 would be quite puzzling. The bottom four quintile metros have similar numbers of native graduates relative to their 1980 populations, between 18 and 22. The top quintile metros have 27 native graduates, but this alone does not distinguish them. The importance of attracting migrants can be seen in the way domestic and foreign migrant degree holders augment their workforces. Another characteristic that distinguished the highest and lowest attainment metros is that those in the top quintile have the smallest count of non-degree holding domestic and foreign-born adults relative to their baseline population. Overall, the lowest quintile is dominated by fast-growing metros.

When the metro areas are grouped by the increase in their degree share, it appears that the variation in educating or attracting graduates is very narrow. The sources differ between the quintiles, but each total to near 60 college graduates per 100 adults in 1980. The variation in non-graduates is the difference maker, with fourth quintile metros attracting domestic non-degree holders and fifth quintile metros retaining native non-graduates and attracting unskilled foreign migrants.

The final grouping of metros in Figure 6 is by the ratio of BAs in 2010 to BAs in 1980. This measure clearly favors fast growing cities. If regional policy makers believe bigger-is-better with regards to the total college graduate population, then this analysis suggests aiming all policies to maximizing total population growth.

5.2 Educational attainment of a state's natives

Using the place-of-birth variable, one can calculate the share of people born in each state that have attained a college degree. I treat this as a measure of how much each state, and its parents, school districts, and colleges, invested in education. There are serious limitations to this measure. For example, if a child's parents moved while the child was preschool or elementary aged, the state they moved to should be credited if the child eventually attains a degree. However, most people (79 percent) reside in the state of their birth at least until they are 18 years old. Therefore the large differences we observe between natives of Massachusetts (39 percent attainment) and Kentucky (22 percent attainment) must contain some information about the levels of investment in education. Also, because the college graduation rate can only be calculated at the state level, this measure does not reflect differences in investment between metro areas within states, or between rural, suburban and urban areas.

In figure 8, I plot the state's college share versus the percentage of the state's natives that have obtained a college degree. There is clearly a strong positive relationship (a coefficient of 0.79 in a linear regression). At the state level of aggregation, investments in education appear to benefit the state overall. What about metro areas within the states? In figure 9, we can see that the variation between metros within states is very large. Many states have at least one MSA with over 35 percent of adults holding degrees, and other MSAs with the figure below 20 percent. In general, states where more natives earn degrees have MSAs with higher attainment levels (a coefficient of 0.58 in a linear regression).

There is a positive relationship between native attainment and growth in the skilled work force if growth is measured by the increase in college degree share (see figure 11). However, growth in the number of degree holders favors states that do not have high attainment among their natives (see figure 9). Metro areas in Nevada, Florida, and North Carolina realized the greatest growth in their educated work forces despite the low attainment of those states' natives. Many New England metros, which invest heavily in education, experienced average or below average growth in their graduate totals.

A factor that could weaken the connection between native attainment and the observed college share is the strong link between education levels and mobility. Nationally, only 51 percent of college graduates live in the state they were born in. States vary in how many of their native graduates they retain. Alaska and Wyoming retain less than 30 percent, while Texas and California retain over 60 percent. Figure 10 suggests the states that better educate their natives are actually worse at retaining them (the fitted line has a slope of -0.33) The

New England migration numbers could be overstated because the states' small geographic areas allow people to move across state lines while still being near home. However, even at the regional level, only 65 percent of the college graduates born in the Northeast still reside in the Northeast.

How does the measure of state native degree attainment line up with the graduate growth measures? To answer this, we can look to the plots in figures 12 and 13. I have forced both plots to have the same scale, so that the contribution of natives can be compared to the contribution of migrants. In figure 12, a positive relationship is visible, although it is not large. Metro areas in states whose natives are more likely to attain college degrees have higher counts of native college graduates relative to their adult population in 1980. In contrast, the relationship been native college attainment and college educated migrants (foreign and domestic) is negative. A dozen metro areas in states with low native degree attainment have attracted more than twice as many degree-holding migrants as metros in states with higher native attainment.

Now we turn to the equivalent two graphs for non-degree holders. Are unskilled workers moving to states that have invested in education so that they can earn a living providing services to the high-income professionals? Are they moving to places that make public investments in education and therefore give their children an opportunity for upward mobility? Figure 15 suggests otherwise. None of the metros in states with native attainment above 30 percent are attracting unusually high numbers of unskilled migrants. The relationship between attainment and unskilled natives is also negative. This negative relationship could be driven by a combination of lower fertility, success in transforming non-graduates into graduates, and more outmigration of the unskilled.

After approaching the data from several angles, what can we take away? In general, states with higher degree attainment among their natives have metro areas with higher shares of college graduates and have experienced higher growth in the share of graduates in their metro populations. However, there is large variance within states, so metro areas in states that produce well-educated natives can still end up with low education levels. Conversely, a metro located in a state that does a poor job of educating its natives can still achieve a high level of degree attainment.

As a final summary exercise, table 5 presents the results of some regressions relating the origin-growth measures to the degree share and measures of the increase in college attainment. These regressions are only an exploration of correlation. They are not identifying any causal impact or evaluating policies. There are three sets of regressions with the left hand side variable being the MSA college degree share in 2010, the difference between the degree share in 2010 and 1980, and the ratio of college graduates in the MSA in 2010 versus 1980. Each regression is calculated with a 2010 population weight, emphasizing the large metro areas, and without a population weighting, emphasizing small metros. I present the coefficients, but I will discuss the standardized coefficients because they give insight into the relative influence of the right hand side variables.

The first right hand side variable is the percent of the states' natives that have attained a college degree. This should be positively correlated with the MSA degree shares and attainment growth. The next two variables are the differences between the MSA's origin-growth measures of their native graduates and non-graduates, with the state origin-growth values subtracted off. These differences measure whether a city is collecting its state's native graduates, so they take on high values for state capitals and cities that are the only metro in an otherwise rural state. The migrant variables are the origin-growth measures (not differenced from a state or national value).

The results in table 5 suggest that the variance in attracting migrant college graduates, from other states or countries, has the highest correlation with the degree share. Collecting native college graduates is strongly correlated with the degree share in the unweighted calculation, but it is less important in the weighted estimates that de-emphasize the smaller capitals and college towns. In the weighted estimates, being unattractive to native and migrant non-graduates is more important than collecting native graduates or having high attainment among natives. When the left hand side variable is the increase in the degree share, the contributions of attracting migrant graduates, not attracting non-graduates, and having higher attainment are all of similar magnitude in the weighted estimates. Finally, when the outcome is the ratio of graduates in 2010 to 1980, all measures line up with growth being positive, and native attainment barely matters at all.

6 Discussion

The bulk of education investments in the US are funded by property taxes in sub-metro sized school districts. The parents and immediate neighbors who invest in primary and secondary education are generating a positive externality that is collected largely by the employers and neighbors of their adult children in another state. A classic policy response would be to internalize the externality by shifting funding of education up to the national level. Such a shift seems unlikely, so current policy makers face an unfortunate incentive. Many regional policy makers may believe it is less expensive and more immediately rewarding to attract college graduates from elsewhere than to invest in one's native children.

Educated professionals care about the education of their own children. To attract them to a region, it is important to have some high functioning school districts or private schools in the metro area. Indeed, every state and region does have at least some good schools. However, it seems that it is not necessary to have a high quality education system state-wide because future leaders of the metro area can free-ride off of human capital investments made elsewhere as well. On a national, perhaps even global, level this externality would be expected to result in underinvestment in education. Following the consultant's admonition to "invest in education" may be the right thing to do for many reasons, but it does not guarantee success in the "smart city" race.

When the discussion turns to higher education, it is possible that the cost of education returns its benefit through research. Tuition, supplemented by state taxpayers, pays the salaries of university faculty who spend part of their time doing research. This research can translate into new products or new firms that expand the regional economic base. If the university's research wins prestige, it will attract out-of-town students. Some of the students will form a network there and remain in the area. The benefits of these university-based research hubs will accrue at the metro level, rather than statewide. This corresponds to the observation that many states have one or two metros that are attracting native and migrant graduates. These are often the metros home to major universities.

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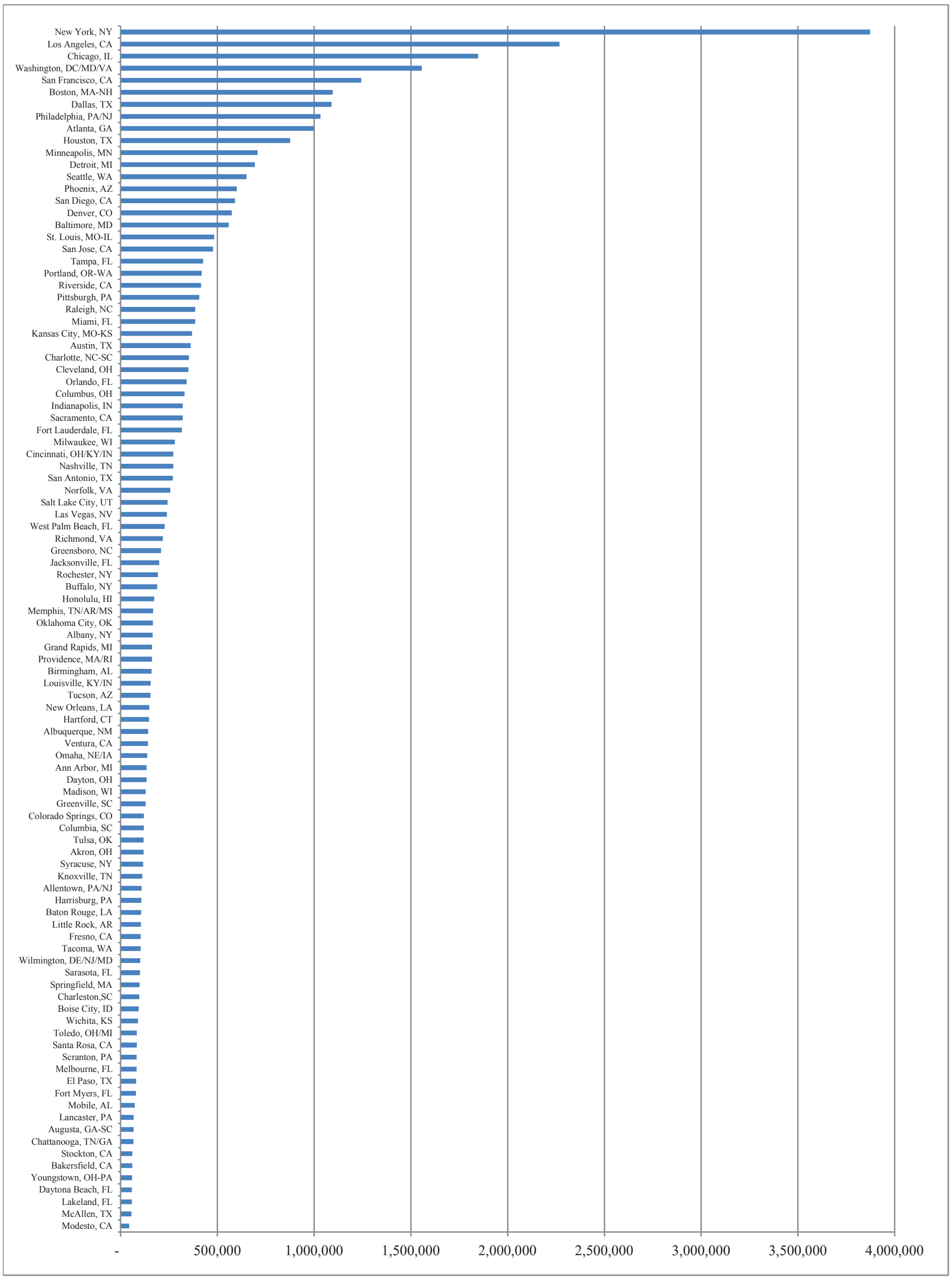

Figure 1: Population of Working Age Adults with a Bachelor's Degree. Labels indicate the metropolitan area by its most populous city. The figures are based on the author's calculations using the pooled 2006-2010 American Community Surveys.

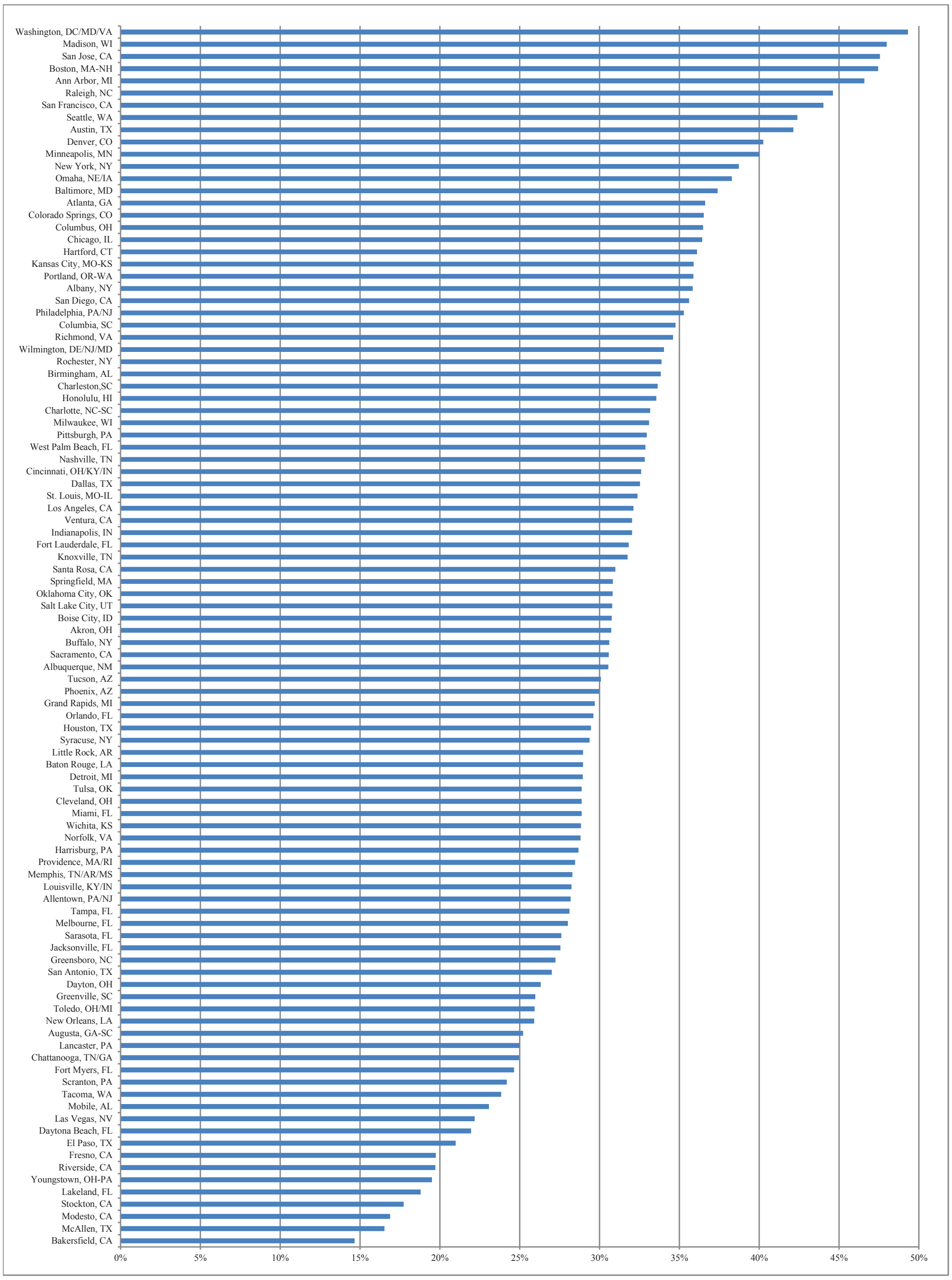

Figure 2: Percentage of Working Age Adults with a Bachelor's Degree. Labels indicate the metropolitan area by its most populous city. The figures are based on the author's calculations using the pooled 2006-2010 American Community Surveys.

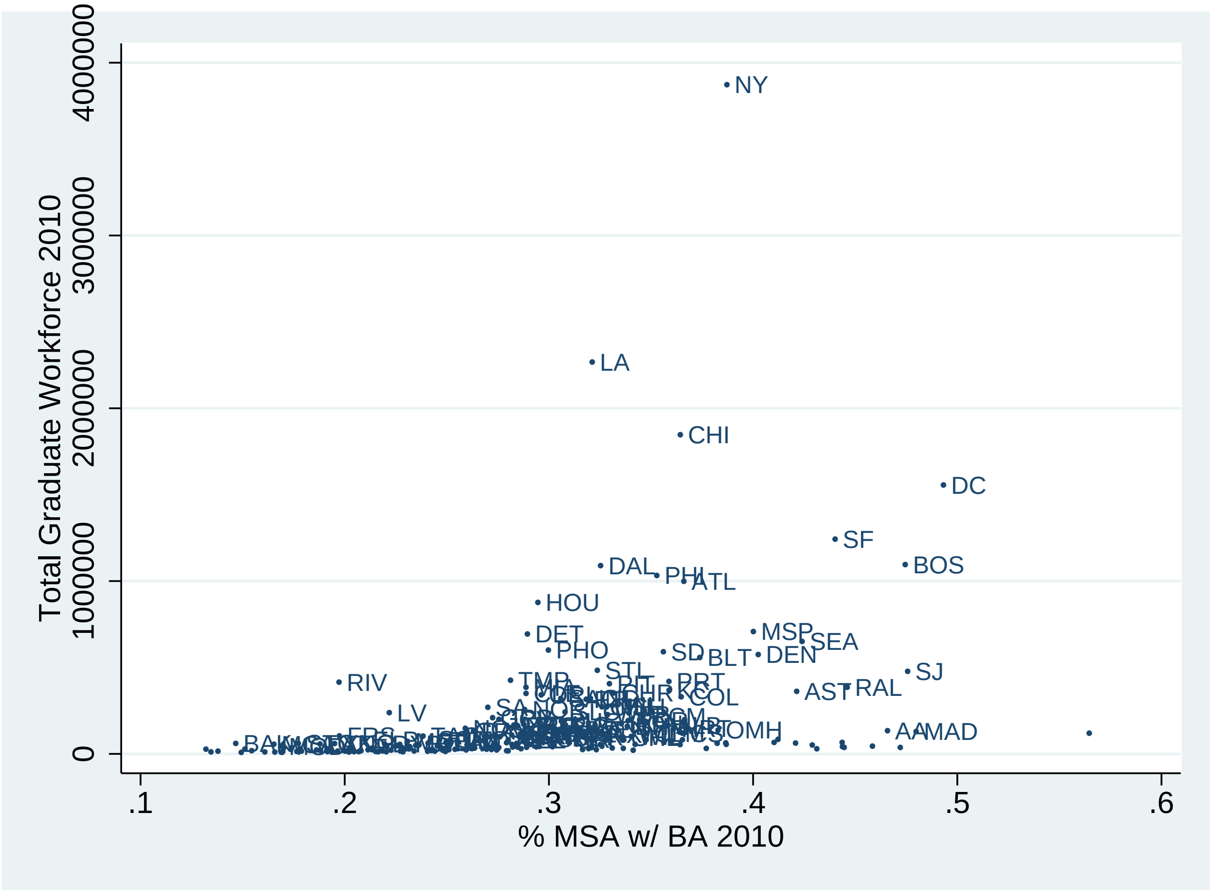

Figure 3: Population of Working Age Adults with a Bachelor's Degree over Percentage of Working Age Adults with a Bachelor's Degree. Label abbreviations indicate the metropolitan area by its most populous city. The figures are based on the author's calculations using the pooled 2006-2010 American Community Surveys.

Rank	Metro	Degree Holder Increase 1980-2010	Rank	Metro	Degree Holder Increase 1980-2010
1	New York, NY	2,219,407	51	Tucson, AZ	97,583
2	Los Angeles, CA	1,265,828	52	Omaha, NE/IA	95,603
3	Chicago, IL	1,074,780	53	Birmingham, AL	94,112
4	Washington, DC/MD/VA	988,246	54	Albuquerque, NM	91,398
5	Atlanta, GA	780,472	55	Ventura, CA	90,287
6	Boston, MA-NH	773,980	56	Colorado Springs, CO	88,523
7	Dallas, TX	763,382	57	Buffalo, NY	87,593
8	San Francisco, CA	710,229	58	Albany, NY	86,527
9	Philadelphia, PA/NJ	587,291	59	Greenville, SC	85,750
10	Houston, TX	547,429	60	Ann Arbor, MI	85,408
11	Phoenix, AZ	461,775	61	Honolulu, HI	84,904
12	Minneapolis, MN	455,661	62	Oklahoma City, OK	83,714
13	Seattle, WA	433,213	63	Sarasota, FL	82,602
14	San Diego, CA	393,902	64	Madison, WI	77,807
15	Detroit, MI	362,308	65	Columbia, SC	77,752
16	Baltimore, MD	353,122	66	Boise City, ID	72,962
17	Denver, CO	342,731	67	Allentown, PA/NJ	70,835
18	Riverside, CA	337,101	68	Harrisburg, PA	68,843
19	Raleigh, NC	320,412	69	Little Rock, AR	68,671
20	Tampa, FL	312,885	70	Hartford, CT	68,072
21	San Jose, CA	289,739	71	Fort Myers, FL	66,474
22	Charlotte, NC-SC	288,203	72	Knoxville, TN	65,782
23	St. Louis, MO-IL	284,561	73	Tacoma, WA	65,726
24	Austin, TX	284,227	74	Charleston,SC	63,269
25	Orlando, FL	282,234	75	Syracuse, NY	62,878
26	Portland, OR-WA	277,869	76	Akron, OH	62,486
27	Miami, FL	244,477	77	Fresno, CA	62,251
28	Kansas City, MO-KS	234,949	78	Baton Rouge, LA	58,363
29	Fort Lauderdale, FL	231,731	79	Wilmington, DE/NJ/MD	57,331
30	Indianapolis, IN	223,053	80	Melbourne, FL	56,261
31	Columbus, OH	220,355	81	Tulsa, OK	56,220
32	Pittsburgh, PA	216,890	82	Springfield, MA	54,617
33	Sacramento, CA	209,090	83	Wichita, KS	54,230
34	Las Vegas, NV	205,418	84	Dayton, OH	53,445
35	Nashville, TN	193,066	85	Santa Rosa, CA	51,421
36	San Antonio, TX	190,756	86	Mobile, AL	50,461
37	Cleveland, OH	182,106	87	El Paso, TX	50,090
38	West Palm Beach, FL	175,287	88	Scranton, PA	50,008
39	Cincinnati, OH/KY/IN	161,515	89	Augusta, GA-SC	46,271
40	Norfolk, VA	160,729	90	New Orleans, LA	45,206
41	Salt Lake City, UT	154,529	91	McAllen, TX	42,203
42	Milwaukee, WI	150,217	92	Daytona Beach, FL	41,752
43	Jacksonville, FL	148,652	93	Lancaster, PA	41,627
44	Greensboro, NC	143,571	94	Lakeland, FL	38,501
45	Richmond, VA	139,608	95	Stockton, CA	38,159
46	Providence, MA/RI	114,358	96	Chattanooga, TN/GA	37,237
47	Grand Rapids, MI	113,873	97	Bakersfield, CA	35,486
48	Rochester, NY	110,022	98	Toledo, OH/MI	32,071
49	Memphis, TN/AR/MS	102,856	99	Youngstown, OH-PA	29,640
50	Louisville, KY/IN	98,745	100	Modesto, CA	28,216

Table 1: Growth Measures of Working Age Adults with a Bachelor's Degree. Label indicates the metropolitan area by its most populous city. The figures are based on the author's calculations using the 1980 Decennial Census pooled 2006-2010 American Community Surveys.

Rank	Metro	Degree Share Increase 1980-2010	Rank	Metro	Degree Share Increase 1980-2010
1	Boston, MA-NH	22.6%	51	Harrisburg, PA	11.6%
2	San Jose, CA	19.4%	52	Fort Myers, FL	11.6%
3	Baltimore, MD	18.8%	53	Louisville, KY/IN	11.6%
4	Charleston,SC	16.9%	54	Norfolk, VA	11.5%
5	New York, NY	16.9%	55	Austin, TX	11.4%
6	Seattle, WA	16.6%	56	Cleveland, OH	11.4%
7	Chicago, IL	16.5%	57	Los Angeles, CA	11.2%
8	Pittsburgh, PA	16.5%	58	Phoenix, AZ	10.8%
9	San Francisco, CA	16.4%	59	Memphis, TN/AR/MS	10.7%
10	Birmingham, AL	16.4%	60	Dallas, TX	10.7%
11	Philadelphia, PA/NJ	16.3%	61	Tulsa, OK	10.7%
12	Omaha, NE/IA	16.3%	62	Oklahoma City, OK	10.6%
13	Raleigh, NC	16.3%	63	Toledo, OH/MI	10.5%
14	Charlotte, NC-SC	16.0%	64	Dayton, OH	10.3%
15	Columbus, OH	15.9%	65	Lancaster, PA	10.3%
16	Kansas City, MO-KS	15.9%	66	Little Rock, AR	10.2%
17	Minneapolis, MN	15.1%	67	Miami, FL	10.1%
18	Madison, WI	15.0%	68	Honolulu, HI	10.1%
19	Fort Lauderdale, FL	15.0%	69	Chattanooga, TN/GA	10.0%
20	Indianapolis, IN	15.0%	70	Rochester, NY	9.8%
21	Colorado Springs, CO	14.9%	71	Mobile, AL	9.8%
22	Nashville, TN	14.3%	72	San Antonio, TX	9.7%
23	Richmond, VA	14.3%	73	Syracuse, NY	9.7%
24	West Palm Beach, FL	14.1%	74	Augusta, GA-SC	9.7%
25	St. Louis, MO-IL	14.1%	75	Santa Rosa, CA	9.7%
26	Milwaukee, WI	14.0%	76	Sarasota, FL	9.4%
27	Cincinnati, OH/KY/IN	14.0%	77	Melbourne, FL	9.0%
28	Washington, DC/MD/VA	14.0%	78	Wichita, KS	9.0%
29	Buffalo, NY	13.9%	79	Sacramento, CA	8.8%
30	Albany, NY	13.9%	80	Salt Lake City, UT	8.8%
31	Providence, MA/RI	13.8%	81	Las Vegas, NV	8.5%
32	Springfield, MA	13.8%	82	Ann Arbor, MI	8.3%
33	San Diego, CA	13.6%	83	Greensboro, NC	8.2%
34	Portland, OR-WA	13.5%	84	Tucson, AZ	8.1%
35	Akron, OH	13.4%	85	Daytona Beach, FL	8.1%
36	Allentown, PA/NJ	13.3%	86	Youngstown, OH-PA	8.0%
37	Detroit, MI	13.2%	87	Albuquerque, NM	7.6%
38	Columbia, SC	13.2%	88	Tacoma, WA	7.6%
39	Atlanta, GA	12.8%	89	Baton Rouge, LA	7.2%
40	Tampa, FL	12.8%	90	Boise City, ID	7.2%
41	Scranton, PA	12.6%	91	El Paso, TX	6.9%
42	Hartford, CT	12.6%	92	New Orleans, LA	6.6%
43	Ventura, CA	12.5%	93	Lakeland, FL	6.2%
44	Orlando, FL	12.4%	94	Houston, TX	5.7%
45	Jacksonville, FL	12.3%	95	McAllen, TX	4.7%
46	Grand Rapids, MI	12.3%	96	Riverside, CA	4.3%
47	Knoxville, TN	12.2%	97	Stockton, CA	4.2%
48	Denver, CO	12.0%	98	Modesto, CA	4.1%
49	Greenville, SC	12.0%	99	Fresno, CA	2.4%
50	Wilmington, DE/NJ/MD	11.6%	100	Bakersfield, CA	1.5%

Table 2: Growth Measures of Working Age Adults with a Bachelor's Degree. Label indicates the metropolitan area by its most populous city. The figures are based on the author's calculations using the 1980 Decennial Census pooled 2006-2010 American Community Surveys.

Rank	Metro	Degree Holder Ratio 2010/1980	Rank	Metro	Degree Holder Ratio 2010/1980
1	Las Vegas, NV	7.15	51	Louisville, KY/IN	2.75
2	Fort Myers, FL	6.15	52	Tucson, AZ	2.75
3	Raleigh, NC	5.91	53	Ann Arbor, MI	2.74
4	Sarasota, FL	5.79	54	Washington, DC/MD/VA	2.74
5	Orlando, FL	5.76	55	Miami, FL	2.73
6	Charlotte, NC-SC	5.46	56	Baltimore, MD	2.72
7	Riverside, CA	5.31	57	Stockton, CA	2.67
8	Austin, TX	4.65	58	Norfolk, VA	2.67
9	Boise City, ID	4.63	59	Houston, TX	2.66
10	Atlanta, GA	4.58	60	El Paso, TX	2.66
11	West Palm Beach, FL	4.37	61	Santa Rosa, CA	2.60
12	Phoenix, AZ	4.32	62	Lancaster, PA	2.59
13	McAllen, TX	4.06	63	Memphis, TN/AR/MS	2.59
14	Jacksonville, FL	3.89	64	San Jose, CA	2.54
15	Colorado Springs, CO	3.79	65	Scranton, PA	2.53
16	Tampa, FL	3.76	66	Wichita, KS	2.51
17	Fort Lauderdale, FL	3.74	67	Madison, WI	2.50
18	Daytona Beach, FL	3.51	68	Fresno, CA	2.48
19	Nashville, TN	3.45	69	Denver, CO	2.48
20	San Antonio, TX	3.42	70	Cincinnati, OH/KY/IN	2.46
21	Boston, MA-NH	3.41	71	St. Louis, MO-IL	2.43
22	Providence, MA/RI	3.37	72	Birmingham, AL	2.42
23	Dallas, TX	3.34	73	Knoxville, TN	2.42
24	Grand Rapids, MI	3.33	74	Bakersfield, CA	2.40
25	Indianapolis, IN	3.27	75	Chicago, IL	2.39
26	Omaha, NE/IA	3.25	76	New York, NY	2.34
27	Mobile, AL	3.24	77	San Francisco, CA	2.33
28	Greensboro, NC	3.18	78	Rochester, NY	2.33
29	Augusta, GA-SC	3.17	79	Philadelphia, PA/NJ	2.32
30	Melbourne, FL	3.14	80	Wilmington, DE/NJ/MD	2.31
31	Columbus, OH	3.00	81	Chattanooga, TN/GA	2.27
32	San Diego, CA	3.00	82	Springfield, MA	2.27
33	Seattle, WA	2.99	83	Los Angeles, CA	2.26
34	Lakeland, FL	2.99	84	Baton Rouge, LA	2.22
35	Greenville, SC	2.97	85	Syracuse, NY	2.17
36	Portland, OR-WA	2.96	86	Milwaukee, WI	2.16
37	Little Rock, AR	2.89	87	Pittsburgh, PA	2.15
38	Charleston,SC	2.89	88	Akron, OH	2.11
39	Sacramento, CA	2.87	89	Detroit, MI	2.09
40	Allentown, PA/NJ	2.86	90	Albany, NY	2.09
41	Columbia, SC	2.84	91	Cleveland, OH	2.08
42	Minneapolis, MN	2.80	92	Oklahoma City, OK	2.01
43	Albuquerque, NM	2.80	93	Youngstown, OH-PA	1.98
44	Ventura, CA	2.78	94	Honolulu, HI	1.95
45	Harrisburg, PA	2.78	95	Tulsa, OK	1.90
46	Richmond, VA	2.77	96	Buffalo, NY	1.87
47	Salt Lake City, UT	2.76	97	Hartford, CT	1.86
48	Kansas City, MO-KS	2.76	98	Dayton, OH	1.66
49	Modesto, CA	2.75	99	Toledo, OH/MI	1.61
50	Tacoma, WA	2.75	100	New Orleans, LA	1.44

Table 3: Growth Measures of Working Age Adults with a Bachelor's Degree. Label indicates the metropolitan area by its most populous city. The figures are based on the author's calculations using the 1980 Decennial Census pooled 2006-2010 American Community Surveys.

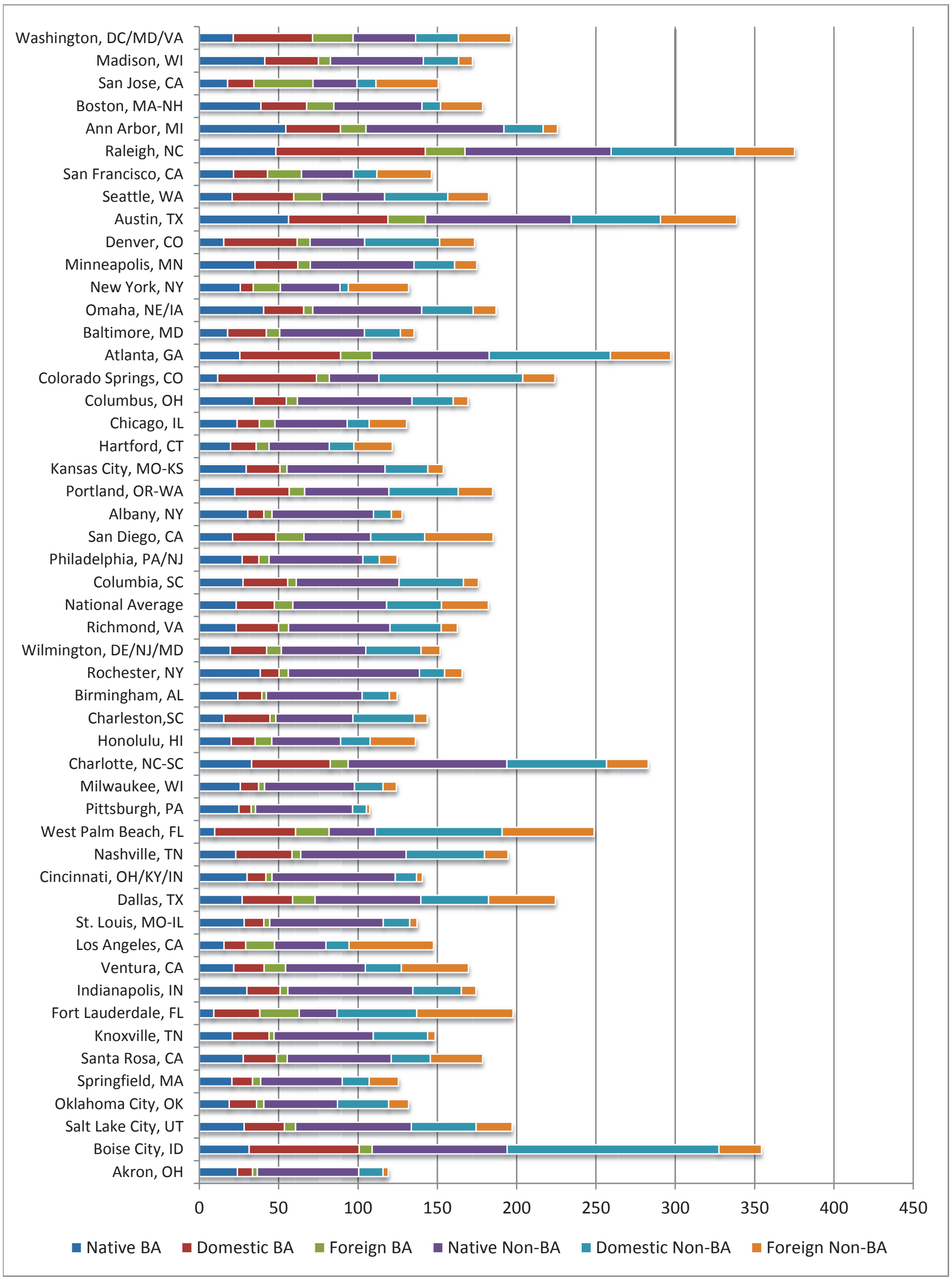

Figure 4: 2010 populations of six categories of working age adults relative to the 1980 population in the MSA. The figures are based on the author's calculations using the 1980 Decennial Census and the pooled 2006-2010 American Community Surveys.

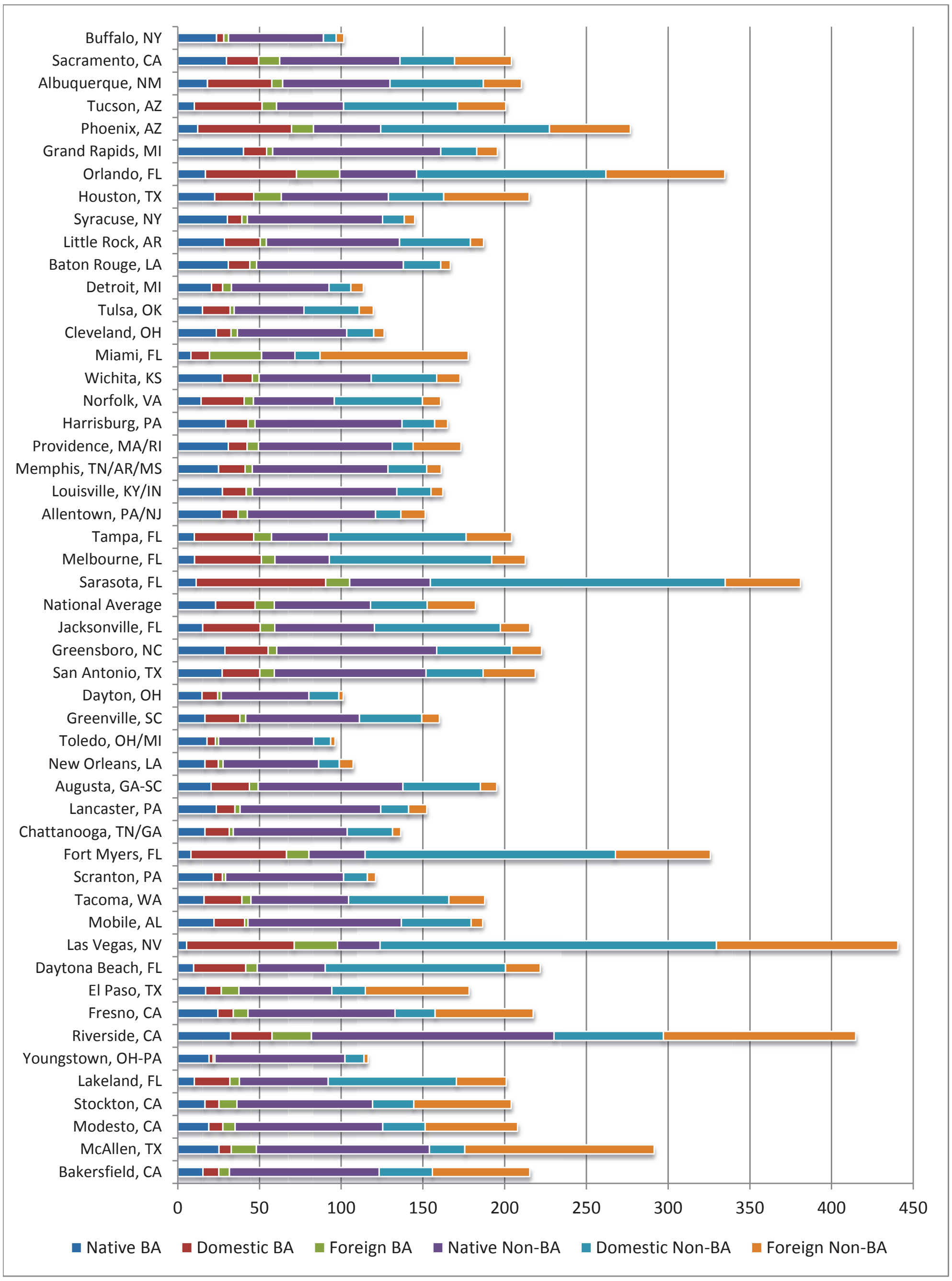

Figure 5: 2010 populations of six categories of working age adults relative to the 1980 population in the MSA. The figures are based on the author's calculations using the 1980 Decennial Census and the pooled 2006-2010 American Community Surveys.

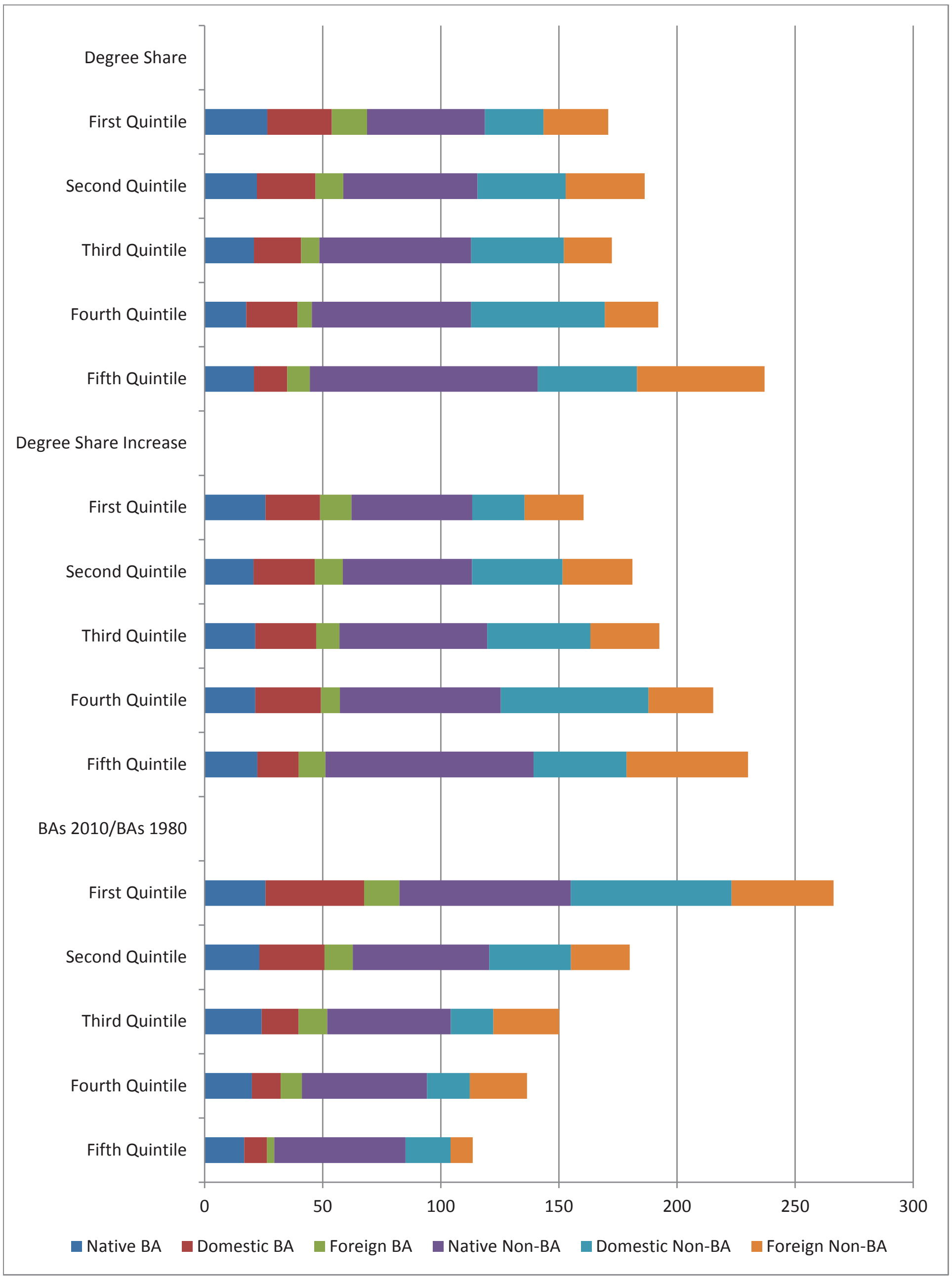

Figure 6: 2010 populations of six categories of working age adults relative to the 1980 population in the MSA. The counts are weighted averages with quintiles. The quintiles group 239 MSAs first by degree share, then by the increase in the degree share and finally by the ratio of BA holders in 2010 to degree holders in 1980. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations.

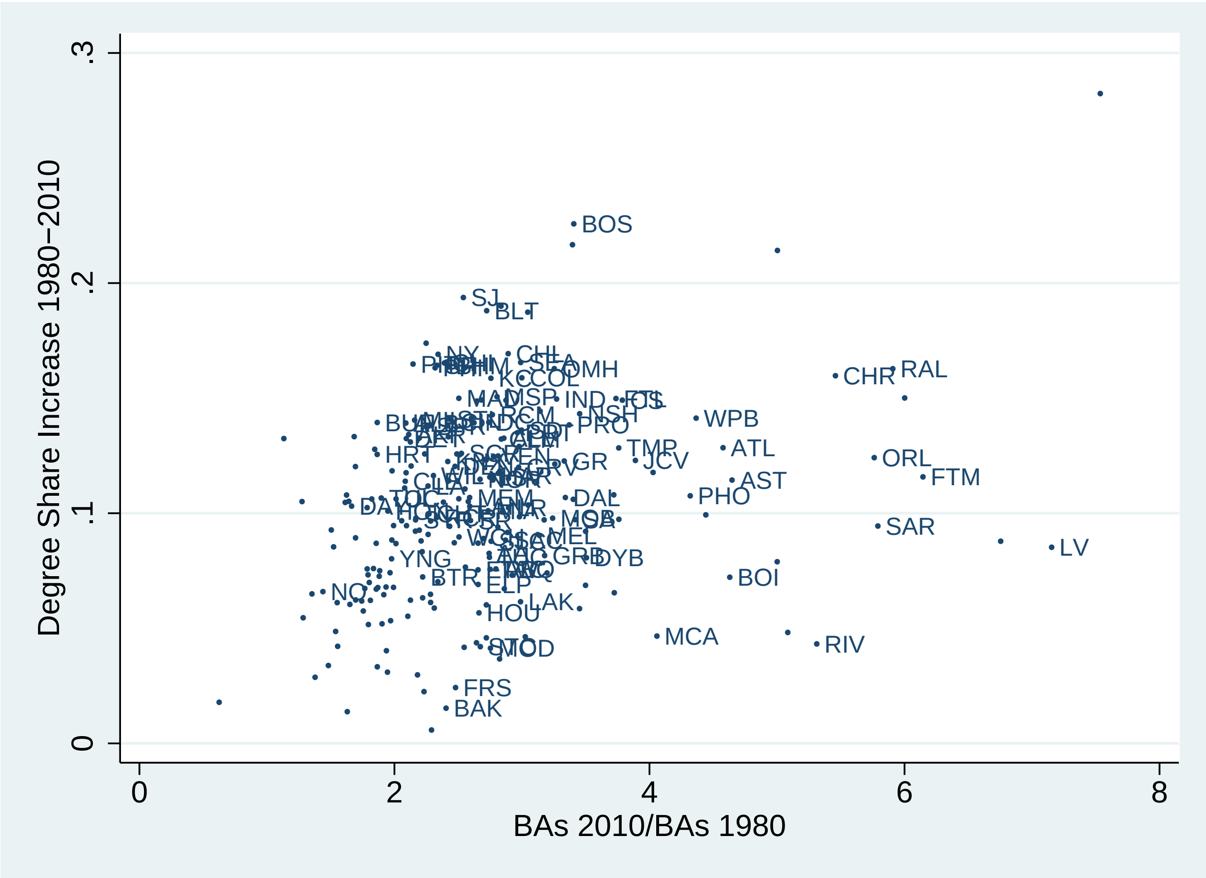

Figure 7: Increase in the Percentage of Working Age Adults with a Bachelor's Degree over the ratio of Bachelor's Degree holders in 2010 to Bachelor's Degree holders in 1980. Label abbreviations indicate the metropolitan area by its most populous city. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations. Fitted line: $Degree\_share\_growth = 5.92 + 0.79(Native\_degree\_attainment)$.

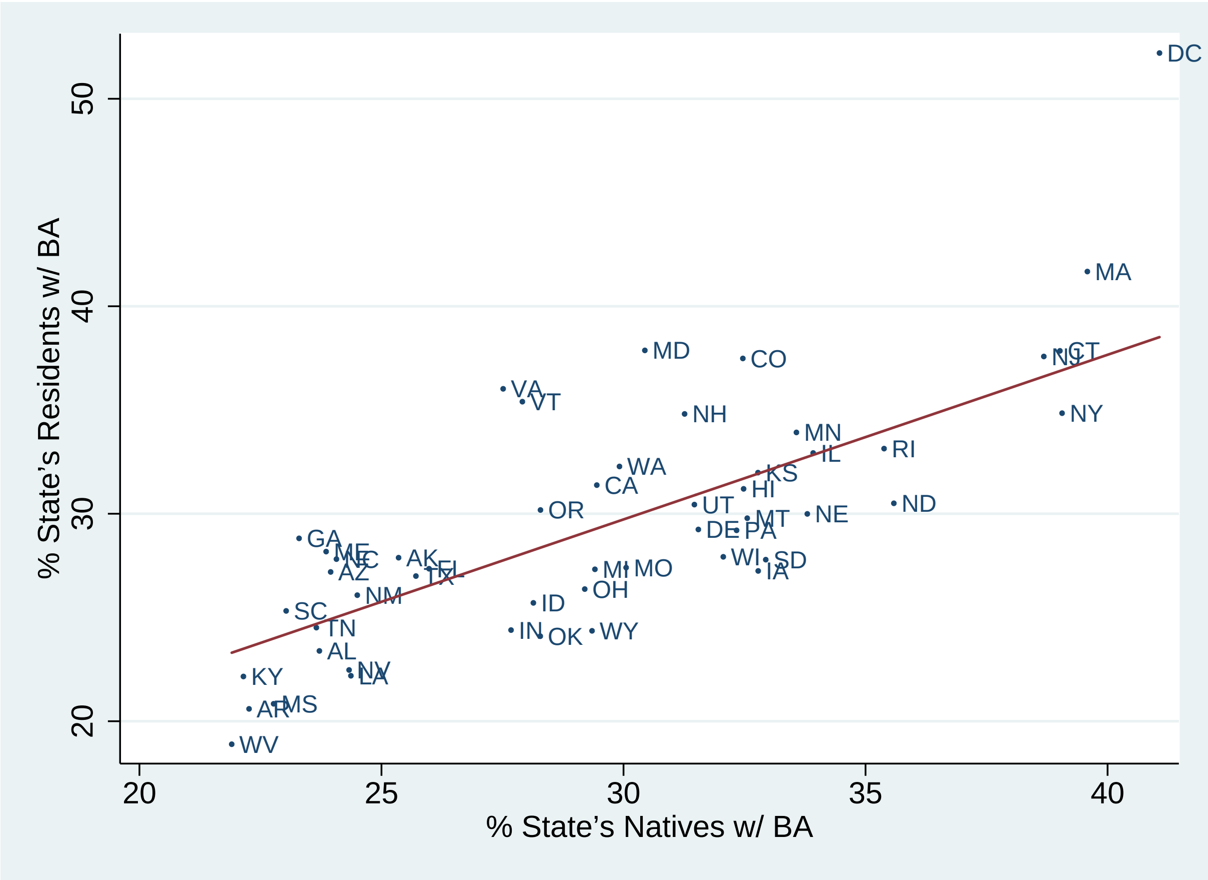

Figure 8: Percentage of Working Age Adults with a Bachelor's Degree over the percent of the states natives (of working age) with a bachelor's degree. Label abbreviations indicate the state of the metropolitan areas' most populous city. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations. Fitted line: $Degree\_share\_growth = 10.1 + 43.9(Native\_degree\_attainment)$.

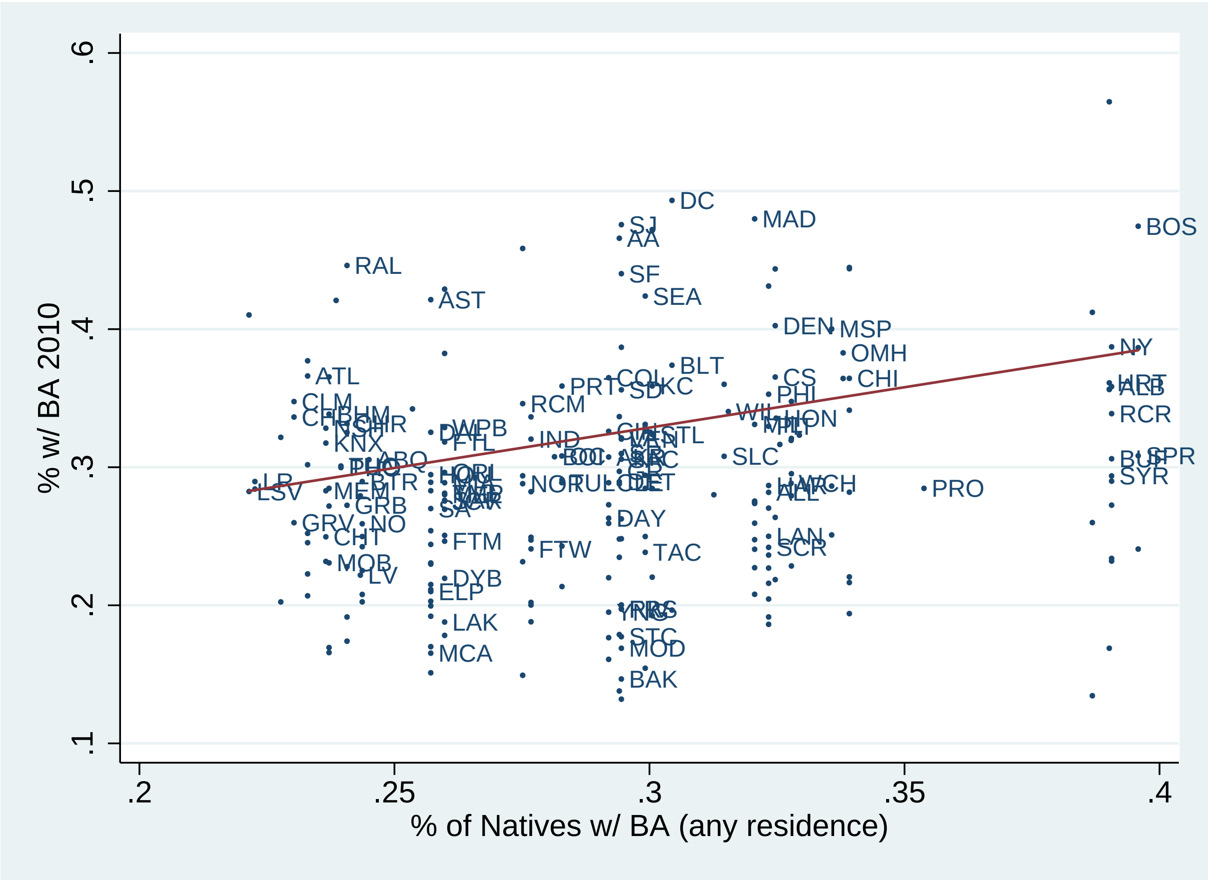

Figure 9: Percentage of Working Age Adults with a Bachelor's Degree over the percent of the states natives (of working age) with a bachelor's degree. Label abbreviations indicate the metropolitan areas' most populous city. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations. Fitted line: $Metro\_degree\_share = 0.15 + 0.59(Native\_degree\_attainment)$.

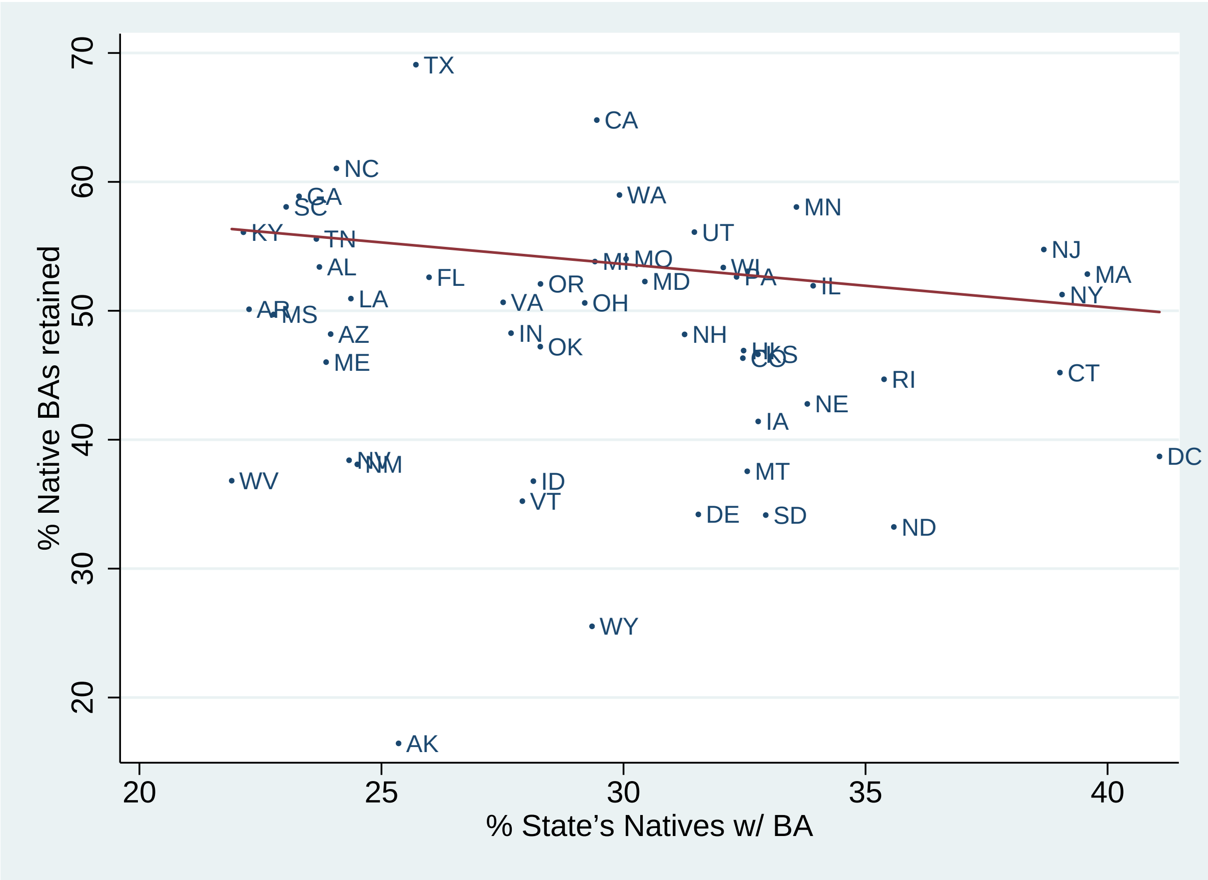

Figure 10: Percentage of Working Age Adults with a Bachelor's Degree who reside in their state of birth over the percent of the states natives (of working age) with a bachelor's degree. Label abbreviations indicate the state of the metropolitan areas' most populous city. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations. Fitted line: $Grads\_in\_birth\_state = 63.7 - 0.33(Native\_degree\_attainment)$.

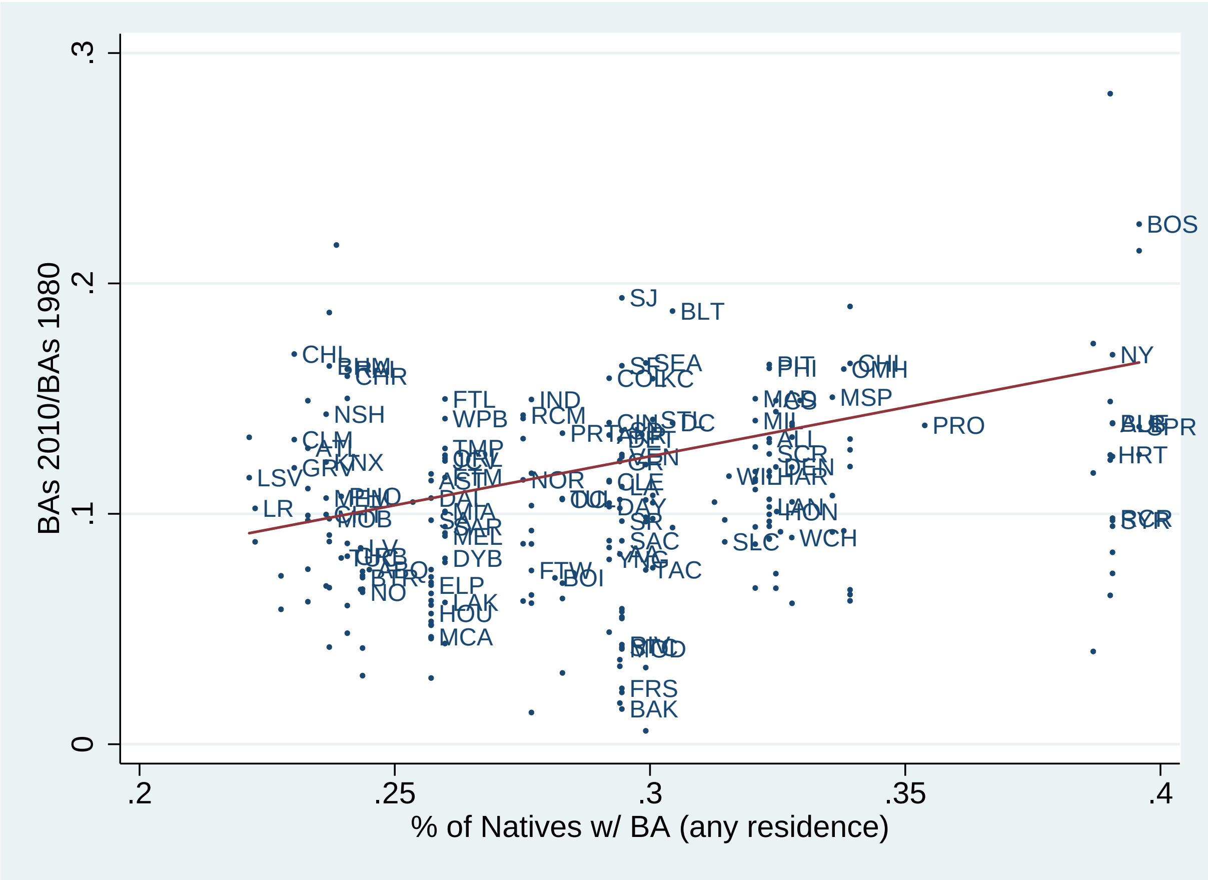

Figure 11: Increase in the Percentage of Working Age Adults with a Bachelor's Degree over the percent of the states natives (of working age) with a bachelor's degree. Label abbreviations indicate the metropolitan areas' most populous city. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations. Fitted line: $Metro\_grad\_growth = -0.003 + 0.43(Native\_degree\_attainment)$

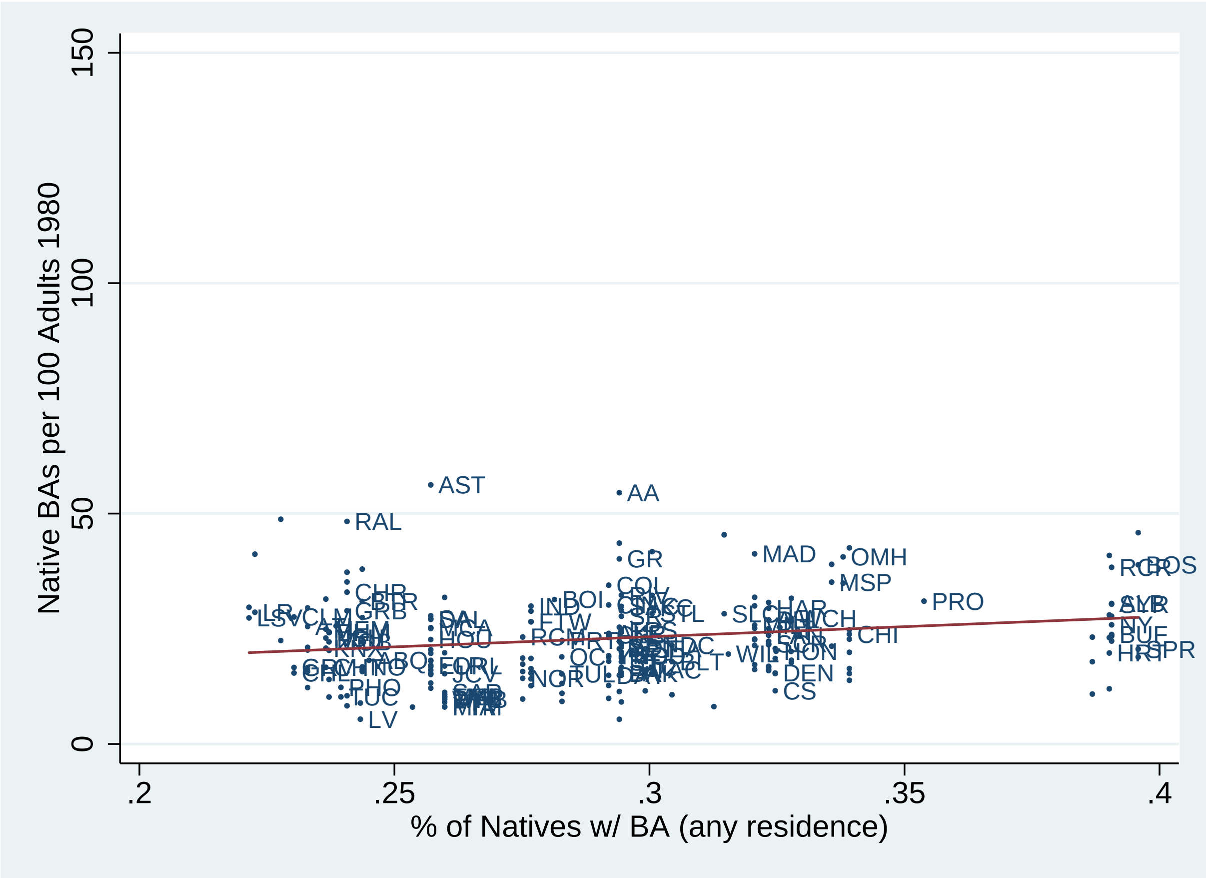

Figure 12: Native bachelors degree holders per 100 over the percent of the states' natives with a bachelor's degree. Label abbreviations indicate the state of the metropolitan areas' most populous city. Source: 2006-2010 American Community Surveys, author's calculations. Fitted line: $Origin\_growth\_native\_grads = 10.1 + 43.9(Native\_degree\_attainment)$

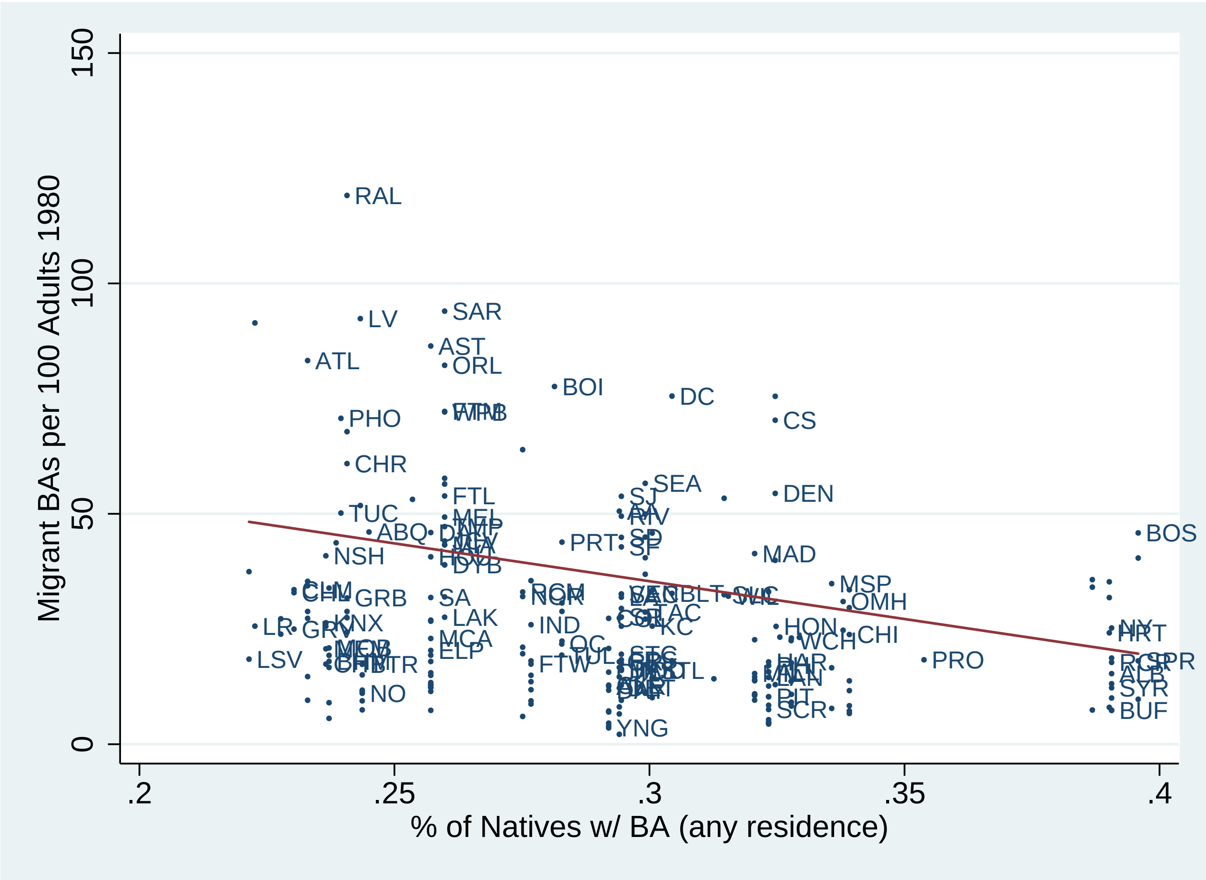

Figure 13: Migrant (domestic and foreign) bachelors degree holders per 100 over the percent of the states' natives with a bachelor's degree. Label abbreviations indicate the metropolitan areas' most populous city. Source: 2006-2010 American Community Surveys, author's calculations. Fitted line: $Origin\_growth\_migrant\_grads = 81.74 - 153.6(Native\_degree\_attainment)$

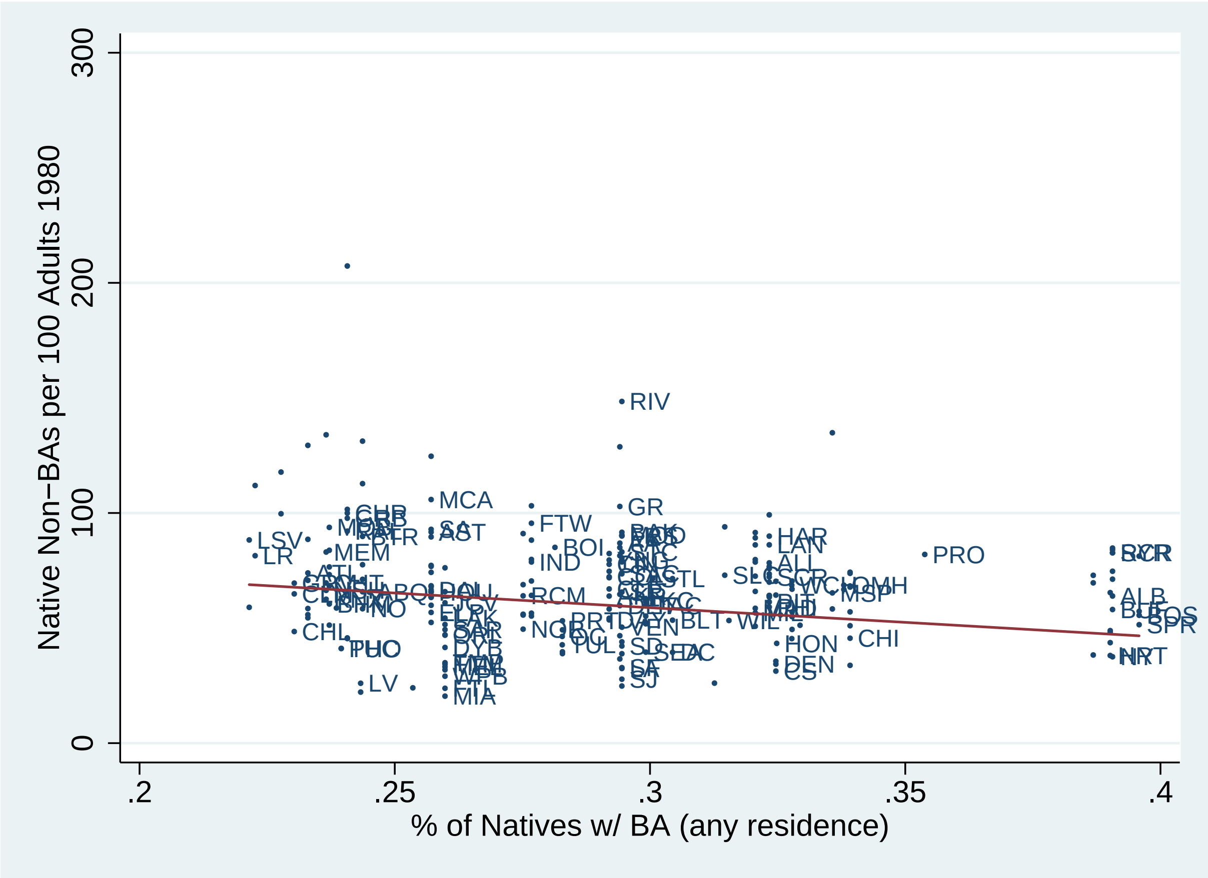

Figure 14: Native bachelors degree holders per 100 over the percent of the states' natives with a bachelor's degree. Label abbreviations indicate the metropolitan areas' most populous city. Source: 2006-2010 American Community Surveys, author's calculations. Fitted line: $Origin\_growth\_native\_nongrads = 97.1 - 127.5(Native\_degree\_attainment)$

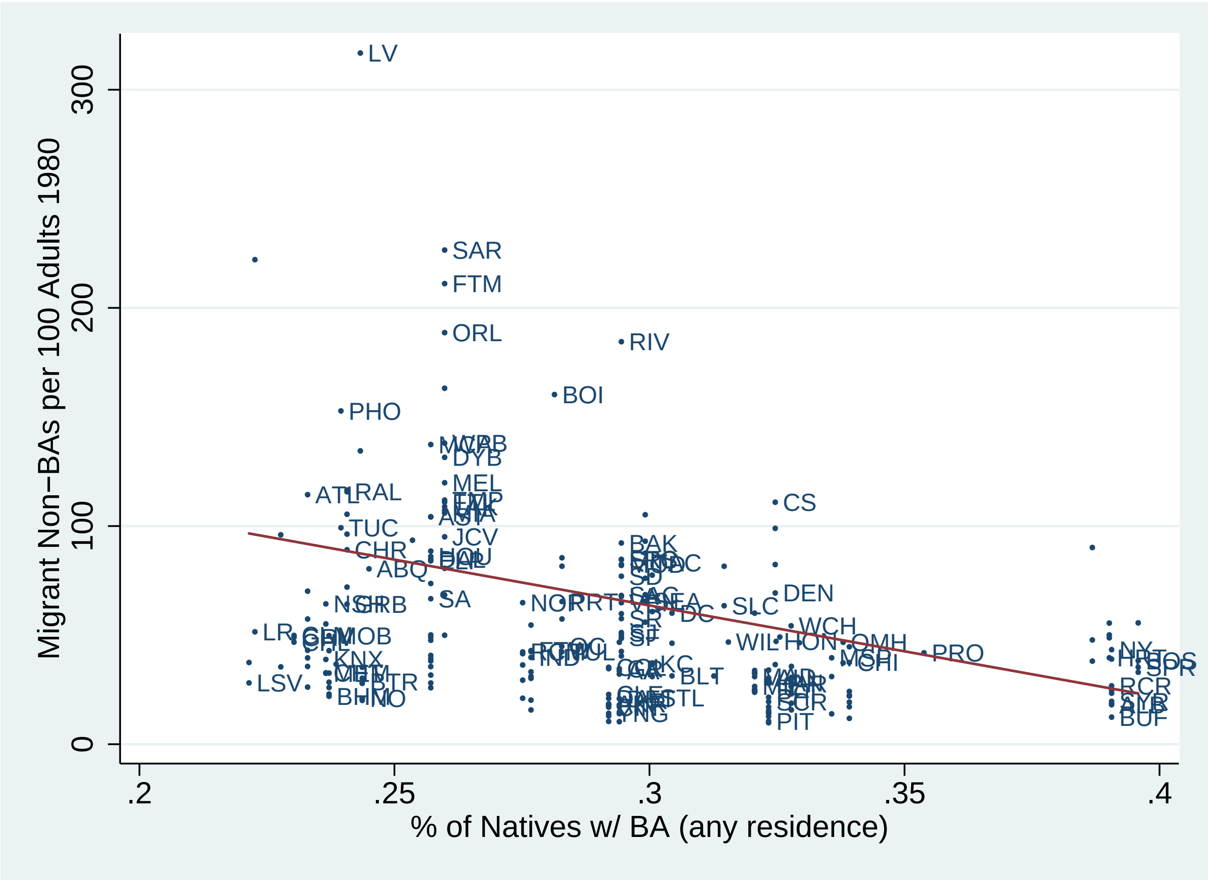

Figure 15: Migrant (domestic and foreign) bachelors degree holders per 100 over the percent of the states' natives with a bachelor's degree. Label abbreviations indicate the metropolitan areas' most populous city. Source: 2006-2010 American Community Surveys, author's calculations. Fitted line: $Origin\_growth\_migrant\_nongrads = 188.1 - 414.3(Native\_degree\_attainment)$

	Mean	SD	Min	Max
Degree Share 2010	28.5	7.8	13.2	56.5
Degree Share 2010-Degree Share 1980	10.2	4.2	.6	28.2
BAs 2010/BAs 1980	269.2	103.5	62.5	753.5
Native Attainment	.29	.05	.22	.40
Attract/Retain Native Graduates	4.52	8.54	-14.29	40.77
Attract/Retain Native Non-Graduates	25.03	22.12	-41.65	160.13
Attract Migrant Graduates	27.76	21.94	2.15	171.77
Attract Migrant Non-Graduates	55.03	42.41	9.83	316.83

Table 4: Measures of MSA college degree attainment, increases in degree attainment, and origin-growth measures.

Population Weighted Regressions			
	BA Share	BA Share Growth	BA Population Growth
Native Attainment	55.35 * **	36.03 * **	129.25
	(5.03)	(5.42)	(77.16)
Attract/Retain Native Graduates	0.41 * **	0.15*	2.03*
	(0.08)	(0.07)	(0.96)
Attract/Retain Native Non-Graduates	−0.17 * **	−0.08 * **	1.08 * *
	(0.03)	(0.02)	(0.35)
Attract/Retain Migrant Graduates	0.26 * **	0.08 * *	1.64 * *
	(0.04)	(0.03)	(0.55)
Attract/Retain Migrant Non-Graduates	−0.09 * **	−0.04 * *	1.21 * **
	(0.01)	(0.01)	(0.24)
Constant	13.73 * **	1.75	83.91 * *
	(2.20)	(1.90)	(29.69)
R^2	0.90	0.60	0.87
Standardized Coefficients			
	BA Share	BA Share Growth	BA Population Growth
Native Attainment	0.36 * **	0.41 * **	0.06
Attract/Retain Native Graduates	0.41 * **	0.27*	0.14*
Attract/Retain Native Non-Graduates	−0.50 * **	−0.44 * **	0.23 * *
Attract/Retain Migrant Graduates	0.78 * **	0.45 * *	0.35 * *
Attract/Retain Migrant Non-Graduates	−0.59 * **	−0.43 * *	0.55 * **

Unweigted Regressions			
	BA Share	BA Share Growth	BA Population Growth
Native Attainment	40.43 * **	24.08 * **	114.81
	(4.64)	(4.73)	(72.13)
Attract/Retain Native Graduates	0.55 * **	0.13 * *	0.92
	(0.07)	(0.05)	(0.62)
Attract/Retain Native Non-Graduates	−0.19 * **	−0.07 * **	1.44 * **
	(0.03)	(0.01)	(0.19)
Attract/Retain Migrant Graduates	0.24 * **	0.12 * **	2.30 * **
	(0.05)	(0.02)	(0.36)
Attract/Retain Migrant Non-Graduates	−0.09 * **	−0.05 * **	1.03 * **
	(0.02)	(0.01)	(0.16)
Constant	17.27 * **	3.60*	74.58 * *
	(1.72)	(1.47)	(22.59)
R^2	0.88	0.54	0.84
Standardized Coefficients			
	BA Share	BA Share Growth	BA Population Growth
Native Attainment	0.23 * **	0.26 * **	0.05
Attract/Retain Native Graduates	0.60 * **	0.27 * *	0.08
Attract/Retain Native Non-Graduates	−0.54 * **	−0.37 * **	0.31 * **
Attract/Retain Migrant Graduates	0.66 * **	0.64 * **	0.49 * **
Attract/Retain Migrant Non-Graduates	−0.48 * **	−0.49 * **	0.42 * **

Table 5: Regressions of College Degree Share and Growth Measures. N=239 for all models. Source: 1980 Decennial Census, 2006-2010 American Community Surveys, author's calculations.