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# Regional Economic Indicators: Human Capital and Workforce

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as part of:  
**The CSU Presidential Initiative for Economic  
Development**

February 2006

**REGIONAL  
ECONOMIC  
INDICATORS:**

**HUMAN CAPITAL  
AND WORKFORCE**



**CENTER FOR  
ECONOMIC  
DEVELOPMENT**

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## **EXECUTIVE SUMMARY**

The report is prepared by the Center for Economic Development at Cleveland State University's Maxine Goodman Levin College of Urban Affairs as a part of the regional indicators project under the Presidential Initiative Program. The study examines human capital and labor force in 36 regions across the country: 32 metropolitan areas of comparable size to the Cleveland metropolitan statistical area (MSA) and three smaller MSAs in Northeast Ohio — Akron,<sup>1</sup> Canton, and Youngstown.

This study builds upon existing research and creates a framework that combines the elements of a broader human capital concept with the more narrow definition of labor force. It looks at some properties of human capital and assesses indicators such as educational attainment and participation in education, but omits health indicators and mortality statistics. The framework also includes labor force participation and unemployment rates that reflect a region's workforce utilization.

The study creates four indices that assess the regions' human capital and workforce: the Population Pipeline Index, the Workforce Pipeline Index, the Workforce Quality Index, and the Workforce Utilization Index. These indices rank metropolitan areas by quality of existing human capital, utilization of the labor force, and the workforce future availability. We do not calculate a single index of human capital and workforce.

This report is composed of three main sections: (1) the overall research methodology, (2) analysis and ranking by the four human capital and workforce indices, and (3) appendices with a detailed description of each variable and indicator that compose the four human capital and workforce indices (Appendices A, B, C, and D), and data sources (Appendix E).

Analyzing rankings across all four indices shows that Austin scores the highest overall, placing it in the top five metro areas in three indices. Denver and San Diego are also highly ranked in all categories. In contrast, Cleveland is ranked close to the middle, #17, in the Workforce Quality Index and scores among the five lowest-ranked metro areas on the other three indices: #27 in the Workforce Pipeline Index, # 32 in the Workforce Utilization Index, and #33 in the Population Pipeline Index. Among the three smaller Northeast Ohio metro areas, only the Akron metro area shows some success. Akron is ranked within the upper half in workforce pipeline (#10) and workforce utilization (#14), but scores lower in workforce quality (#21) and in population pipeline (#27). Youngstown has the worst ranking of all metro areas in our sample, scoring among the lowest five in all four indices.

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<sup>1</sup> Throughout this report, we use only the first city from the name of the metropolitan statistical area (MSA). All tables contain the full names of the MSAs and their corresponding states.



Other Midwest<sup>2</sup> metro areas are ranked very low in population pipeline and workforce utilization. In workforce quality, however, Minneapolis scores #2, Milwaukee #8, and Columbus #9. In workforce pipeline, Pittsburgh scores #10 — the highest of all Midwestern metro areas; Columbus is ranked #14 and Akron #16.

## **Workforce Quality Index**

The Workforce Quality Index describes the quality of the existing and available workforce in a particular region. It is composed of the educational attainment of the population and employment in high-tech and creative occupations.

Led by the Austin metropolitan area, the top five metro areas in the Workforce Quality Index include #2 Minneapolis, #3 Denver, #4 Seattle, and #5 Portland with a significantly lower index. The highest-ranked regions in the Workforce Quality Index all ranked high in graduate/professional degrees and bachelor's degrees, as well as in high-tech and creative occupations. The lowest Workforce Quality Index is observed in #32 Memphis, #33 Canton, #34 Youngstown, #35 Las Vegas, and #36 Riverside.

In the Quality of Workforce Indicator, Cleveland is ranked #17 and performs well in the number of people with a graduate/professional degree (#13) and people in high tech and creative occupations (both #19). It clearly underperforms in the share of population with bachelor's and associate's degrees (both #23). Akron is ranked #21, scoring high (#4) in both high school graduates and population with less than a high school degree. Akron's lowest rankings are in creative occupations (#29) and in some college/associate's degree (#25).

Several Midwestern metro areas are ranked higher than Cleveland in bachelor's degrees. Minneapolis takes the top position among all Midwestern metro areas in all indicators. At the other end of the spectrum, Youngstown and Canton ranked among the five lowest areas in the majority of indicators and in the overall Quality of Workforce Index.

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<sup>2</sup> To benchmark Cleveland and the three smaller Northeast Ohio metro areas, we established a small sample of metro areas, which include Great Lakes metro areas, some additional Midwestern metro areas, and the Pittsburgh MSA, which is often compared with the Cleveland MSA. These metro areas are shown on the figures in Appendices A, B, C, and D along with the top five and bottom five metro areas in each indicator. The sample includes: Buffalo, Cincinnati, Columbus, Indianapolis, Louisville, Minneapolis, Milwaukee, Pittsburgh, and (in some cases) St. Louis. Throughout the report we refer to this smaller sample as to Midwestern metro areas.

## **Workforce Pipeline Index**

The Workforce Pipeline Index describes the educational level of tomorrow's regional workforce. It is calculated from two sets of indicators, students and domestic net migration by educational attainment.

The top-ranked metropolitan areas in the Workforce Pipeline Index are Austin (#1), Orlando (#2), Oklahoma City (#3) Las Vegas (#4), and Sacramento (#5). These places are either home to large universities or have a comparably small workforce with high positive net migration to their areas.

To emphasize the science and engineering (S&E) specialization among students and university graduates, we separated them from non-S&E students and graduates and ranked metro areas by each indicator. This exercise is supported by the notion that technology-based economic development is driving the economic success of many regions and that it occurs in areas with a high concentration of knowledge and a technologically sophisticated workforce. The knowledge-intense and technologically sophisticated future workforce can best be represented by the science and engineering specializations of today's students and graduates. The assumption accompanying this argument is that a given regional economy has sufficient science and engineering jobs and is capable of absorbing tomorrow's graduates, keeping enough of them to satisfy the economy's own needs.

Cleveland has an overall rank of #27, with its single highest ranking in total S&E PhD graduates (#13).<sup>3</sup> It scores very low in migration data (between #28 and #31), reflecting the negative net migration in all categories of migrants by educational attainment.

Akron is ranked #16 and has the highest rank of all Northeast Ohio metro areas. It is the second-best after Austin in number of S&E students as a percentage of the workforce, #9 in non-S&E students, and #10 in S&E PhD graduates. Such high scores are influenced by the smaller size of this metro area and the presence of The University of Akron and Kent State University, both of which have large S&E departments.

## **Workforce Utilization Index**

The two previous indices describe the availability and quality of the current and future workforce. However, having a high-quality existing and prospective workforce tells only part of

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<sup>3</sup> Data of students and graduates in Cleveland MSA reflect the presence of Cleveland State University, Case Western Reserve University, and John Carroll University only.

the regional human capital and workforce story. The other part is described by the successful utilization of the workforce, which shows how well a metropolitan economy engages its existing workforce. It reflects both the ability of the regional economy to absorb its workforce and the willingness of people to participate in the regional economy.

The Workforce Utilization Index describes how well the existing workforce is utilized in today's regional economy. It is calculated from the indicators of the labor force participation rate and unemployment rate.

Minneapolis ranks #1 in the Workforce Utilization Index as a result of being #1 in the labor force participation rate (LFPR) and #5 in the unemployment rate. In addition to Minneapolis, two other Midwestern metro areas, Columbus (#3) and Indianapolis (#4), are among the top five in this index. Columbus ranks #6 in LFPR and #7 in unemployment. Indianapolis is #5 in LFPR and #8 in unemployment.

Midwestern metro areas scored very differently in this index. In addition to the three metro areas that are among top five in this index, Cincinnati ranked #7. Akron and Milwaukee come in at #14 and #19, respectively. Canton and Pittsburgh ranked #26 and #30, respectively. Cleveland and Youngstown bring up the rear, scoring among the lowest five metro areas in this index, #32 and #36, respectively; rounding out the bottom five are Seattle (#33), Riverside (#34), and Portland (#35).

## **Population Pipeline Index**

The Population Pipeline Index characterizes potential long-term replenishment of human capital in a region. It is composed of two indicators, which reflect natality and domestic migration.

In the Population Pipeline Index, Las Vegas ranks #1 with the second highest total net migration; Orlando (#2) has the highest migration but a very low number of children aged 0-5. Austin, which ranks #3 in population pipeline, scores #4 in a net migration and #8 in the number of children aged 0-5 as a percentage of total population. Oklahoma City and Charlotte, ranking #4 and #5 in population pipeline, are also high in total net migration (#3 and #6, respectively) and are ranked #17 and #11 in percentage of children aged 0-5.

Among the five lowest-ranked locations, Cleveland is #33 overall, due to a very low ranking in net migration (#35) and a slightly better ranking in children aged 0-5 (#25). Canton (#32) and Youngstown (#35) are also among the five lowest ranked in Population Pipeline. Canton is ranked #31 in both indicators; Youngstown is ranked #34 in the percentage of

children aged 0-5 and #32 in the total net migration. The only non-Midwest metro area among the five worst in population pipeline is Tampa, Florida, with an overall ranking of #34, coming in at #35 in percentage of children aged 0-5 and #29 in total net migration.

An analysis of all indices and indicators reveals that Cleveland has a weak competitive position in the quality of its labor force. It needs to attract and retain more educated people, paying special attention to those with associate's and bachelor's degrees. Despite the fact that Cleveland ranked relatively high in the percentage of S&E PhD graduates, overall it has a relatively small percentage of college students and shows clear signs of exporting people of all educational categories, especially those with some college/associate's degree. Even though the Cleveland metro area shows the in and out migration pattern typical of an area that loses overall population, a serious consideration should be given to the depth of the labor market by educational categories and the area's ability to attract and retain companies that employ an educated workforce.

## INTRODUCTION

This report continues a series of studies on regional indicators that benchmark Cleveland to a number of other metro areas of comparable size, industry structure, and those that are considered fast-growing regions. This report was prepared by the Center for Economic Development at Cleveland State University's Maxine Goodman Levin College of Urban Affairs as a part of the regional indicators project under the Presidential Initiative Program. The project is also sponsored by the Northeast Ohio Research Consortium of the Ohio Urban University Program.

This study examines human capital and labor force in 36 regions across the country: 32 metro areas of comparable size to the Cleveland MSA and three smaller metro areas in Northeast Ohio — Akron, Canton, and Youngstown.

The study creates four indices that assess each regions' human capital and rank metropolitan areas by quality of existing human capital, utilization of the labor force, future availability of workforce, and the future availability of human capital. The analysis aims to determine factors that contribute to the human capital success of some regions and identify shortages for others. Similar to the previous studies in this series, the report creates a valuable database of variables and indicators of human capital and labor force for 36 metro areas.

Many regional studies include human capital and utilization of labor force indicators to assess an area's competitiveness. They either describe one region (county, metro area, or state) or compare regions (metro areas or states). Within their frameworks, the studies assess labor markets using such traditional indicators as educational attainment<sup>4</sup> and unemployment rates,<sup>5</sup> and specific indicators such as the number of science and engineering graduate students and degrees awarded,<sup>6</sup> online population, or classroom Internet connectivity.<sup>7</sup>

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<sup>4</sup> *Washington State 2004 Index of Innovation and Technology*. (April 2004). Washington Technology Center. [www.watechcenter.org](http://www.watechcenter.org); *The 2002 Metropolis Index (Chicago)*. (2002). Chicago Metropolis 2020. [www.chicagometropolis.org](http://www.chicagometropolis.org); *The 2002 Alaska Science and Technology Innovation Index*. (September 2002). Alaska Science & Technology Foundation. [www.astf.org](http://www.astf.org); *Maine Innovation Index 2002*. (2002). Maine Science & Technology Foundation. [www.mstf.org](http://www.mstf.org); *The Metropolitan New Economy Index*. (April 2001). Case Western Reserve University, Progressive Policy Institute. from [www.ppionline.org](http://www.ppionline.org).

<sup>5</sup> *The 2002 Alaska Science and Technology Innovation Index*. (September 2002). Alaska Science & Technology Foundation. [www.astf.org](http://www.astf.org); *Massachusetts Benchmark: The Quarterly Review of Economic News & Insight*. (Fall 2003). The Massachusetts Benchmarks Project. <http://www.massbenchmarks.org>; *Metro Area and State Competitiveness Report 2003*. (2003). Beacon Hill Institute. <http://www.beaconhill.org>.

<sup>6</sup> *Metro Area and State Competitiveness Report 2003*. (2003). Beacon Hill Institute. <http://www.beaconhill.org>; *Washington State 2004 Index of Innovation and Technology*. (April 2004). Washington Technology Center. [www.watechcenter.org](http://www.watechcenter.org); *Maryland Innovation and Technology Index*. (2003). Maryland Technology Development Corporation. [www.marylandtedco.org](http://www.marylandtedco.org).

<sup>7</sup> *The Metropolitan New Economy Index*. (April 2001). Case Western Reserve University, Progressive Policy Institute. [www.ppionline.org](http://www.ppionline.org); *The 2002 Alaska Science and Technology Innovation Index*. (September 2002). Alaska Science & Technology Foundation. [www.astf.org](http://www.astf.org); *Maine Innovation Index 2002*. (2002). Maine Science & Technology Foundation. [www.mstf.org](http://www.mstf.org).

Chicago<sup>8</sup> and Minnesota<sup>9</sup> studies describe a future workforce pipeline, and Long Island<sup>10</sup> and Chicago studies included health indicators. The Long Island study included the percentage of births that are low weight and mortality rate due to heart disease, and the Chicago study included such variables as health insurance, infant mortality, child immunization, and stroke rates. The Philadelphia Innovation and Entrepreneurial Index report<sup>11</sup> included a creative class ranking (composite rank based on four categories of input: creative class, high tech, innovation, and diversity).

This study builds upon existing research and creates a framework that combines the elements of a broader human capital concept with the more narrow definition of labor force. It looks at some properties of human capital and assesses such indicators as educational attainment and participation in education, but omits health indicators and mortality statistics. The framework also includes labor force participation and unemployment rates that reflect a region's workforce utilization.

This report is composed of three sections. The first section describes the overall research methodology, providing a framework and the elements of human capital and workforce we researched. The second section describes and analyzes four human capital and workforce indices and ranks 36 metro areas according to the indices. The third section provides appendices with a detailed description of each variable and indicator that comprise the four indices of human capital and workforce. Appendices A, B, C, and D graphically depict each variable and compare Cleveland's position and the rankings of the three smaller Northeast Ohio metro areas to other regions. It also presents information on data sources (Appendix E).

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<sup>8</sup> *The 2002 Metropolis Index (Chicago)*. (2002). Chicago Metropolis 2020. [www.chicagometropolis.org](http://www.chicagometropolis.org)

<sup>9</sup> *Minnesota Milestones*. (1998). Minnesota Planning. [www.mnplan.state.mn.us](http://www.mnplan.state.mn.us)

<sup>10</sup> *Long Island Index 2004*. (2004). Long Island Index. [www.longislandindex.org](http://www.longislandindex.org).

<sup>11</sup> *The Philadelphia Innovation and Entrepreneurial Index*. (2002). Innovation Philadelphia. [www.lpphila.com](http://www.lpphila.com). All reports were accessed between September 2004 and January 2006.

## METHODOLOGY

### OVERALL FRAMEWORK

The term human capital conceptualizes workers' skill sets that can be "rented out" to employers, including knowledge and skills, which come from education, training, and experience and which generate a stock of productive capital. The value of this stock of skills is derived from how much these skills can earn in the labor market. The value is affected by migration and the utilization level of the existing pool of labor.<sup>12</sup>

The human capital concept is often tied to broader values and concerns about education and the health of the population. In this report, we use a narrow definition of human capital and link its value to the knowledge and skills of the working-age population and an area's ability to sustain existing labor markets through natality and migration.

We do not calculate a single index of human capital and workforce. Instead, we calculate four indices: population pipeline, workforce pipeline, workforce quality, and workforce utilization (Table 1).<sup>13</sup> The Population Pipeline Index characterizes potential long-term replenishment of human capital in a region. It is composed of two indicators, which reflect natality and domestic migration. The Workforce Pipeline Index describes the educational level of tomorrow's regional workforce. It is calculated from two sets of indicators, students and domestic net migration by educational attainment. The Workforce Quality Index describes the quality of the existing and available workforce in a particular region. It is composed of the educational attainment of the population and employment in high-tech and creative occupations. The Workforce Utilization Index shows how well metropolitan economies engage their existing workforce. It reflects both the ability of the regional economy to absorb its workforce and the willingness of people to participate in the regional economy.

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<sup>12</sup> Ehrenberg, R. and Smith R. (2003) *Modern Labor Economics*, Addison-Wesley, p.290.

<sup>13</sup> The development of this framework was influenced by three studies: Conway, C. and Sandra Johnson (2005) *The Southern Workforce Index*, Southern Growth Policies Board; Rugerri, G.C. and W. Yu (2000) *On the Dimensions of Human Capital: An Analytical Framework*, Atlantic Canada Economics Association Papers, 29: pp. 89-102; and Yu, W. (2001) *A Survey of Existing Indicators for Human Capital*, Background Paper for the Human Capital Cluster Group Prepared for the National Round Table on the Environment and the Economy's Environmental and Sustainable Development Indicators Initiative. [http://www.nrtee-trnee.ca/eng/programs/current\\_programs/SDIndicators/clustergroups/ClusterGroup\\_BackgroundDocuments\\_HumanCapital\\_e.htm](http://www.nrtee-trnee.ca/eng/programs/current_programs/SDIndicators/clustergroups/ClusterGroup_BackgroundDocuments_HumanCapital_e.htm)

**Table 1. Human Capital and Workforce Indicators**

<b>Index</b>	<b>Indicator</b>
<b>Population Pipeline</b>	
	Children aged 0-5 as a percentage of total population
	Total net migration aged 25+ as a percentage of total population aged 25+
<b>Workforce Pipeline</b>	
	<i>Regional future workforce by education:</i>
	High school graduates as a percentage of workforce
	Total number of non-science and engineering students in universities as a percentage of workforce
	Total number of science and engineering (S&E) students as a percentage of workforce
	Total number of university PhD non-S&E graduates as a percentage of workforce
	Total number of university PhD S&E graduates as a percentage of workforce
	<i>Net migration of people by educational attainments:</i>
	Net migration of people with some college/associate's degree as a percentage of workforce
	Net migration of people with undergraduate degree as a percentage of workforce
	Net migration of people with graduate degree as a percentage of workforce
<b>Workforce Quality</b>	
	<i>Educational attainments:</i>
	Number of people with less than high school diploma as a percentage of total population aged 25-64
	Number of people with high school or equivalent degree as a percentage of total population aged 25-64
	Number of people with some college/associate's degree as a percentage of total population aged 25-64
	Number of people with bachelor's degree as a percentage of total population aged 25-64
	Number of people with graduate/professional degree as a percentage of total population aged 25-64
	<i>High-tech and creative occupations:</i>
	Number of employees in high-tech occupations as a percentage of workforce
	Number of employees in creative occupations as a percentage of workforce
<b>Workforce Utilization</b>	
	Labor force participation rate
	Unemployment rate

The importance of each of these indices depends on the area's immediate opportunities and challenges. Regional public policies should be implemented in regard to all four indices; this is why the 36 metropolitan areas were ranked by each index separately. Nevertheless, we consider the workforce quality and workforce pipeline indices as critical for an immediate assessment of the economic potential of each metro area.

## **ESTIMATING WEIGHTS OF INDIVIDUAL INDICATORS**

To calculate each of the four indices, we used various indicators that reflect our framework (Table 1). There are different weights assigned to individual indicators within each of these four indices.



## **Population Pipeline Index and Workforce Utilization Index**

To calculate the Population Pipeline Index, equal weight was assigned to the two indicators that compose this index: children aged 0-5 as a percentage of total population and net migration as a percentage of total population. These indicators represent two important sources of population growth in an area, natural growth and migration. We also assigned an equal weight to two indicators within the Workforce Utilization Index: labor force participation rate and unemployment rate. These indicators reflect the willingness of residents to work and the ability of a regional economy to absorb those who are willing to work there.

## **Workforce Pipeline Index**

To assign weights to indicators within the Workforce Pipeline Index, we used the 2003 average total personal income of the U.S. population age 25 and older specified by educational attainment.<sup>14</sup> Using the income of those with less than a high school diploma as the baseline, the ratio of income to educational attainment was calculated as:

- high school diploma – 1.64;
- some college (includes AS, AA, certificates) – 2.13;
- bachelor's degree (includes BA, AB, BS) – 3.18;
- advanced degree (includes MA, MS, PhD, first professional) – 4.65.

These ratios are assigned as weights to different categories of the region's future workforce — those who today are in high school and college and will potentially enter the workforce in the near future and to in-migrants with the same level of educational attainment.

To emphasize the science and engineering (S&E) specialization among students and university graduates, we separated them from non-S&E students and graduates and ranked metro areas by each indicator. This exercise is supported by the notion that technology-based economic development is driving the economic well-being of many regions and that it occurs in areas with a high concentration of knowledge and a technologically sophisticated workforce. The knowledge-intense and technologically sophisticated future workforce can best be represented by the science and engineering specializations of today's students and graduates. The assumption accompanying this argument is that a given regional economy has sufficient

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<sup>14</sup> *The Investment Payoff. A 50-State Analysis of the Public and Private Benefits of Higher Education.* Institute for Higher Education Policy. February 2005. [www.ihep.org](http://www.ihep.org)

science and engineering jobs and is capable of absorbing tomorrow's graduates, keeping enough of them to satisfy the economy's own needs. The weights given to the two clusters of indicators in the Workforce Pipeline Index are also adjusted by the shares of migrants and students in a population. Thus we do not overemphasize the importance of educated migrants who, on average, represent no more than 1.4 percent of the regional workforce in our sample.

### **Workforce Quality Index**

The Workforce Quality Index characterizes the existing regional labor market. It is composed of two categories of indicators, those that characterize the labor market's educational attainments and those that represent high-tech and creative occupations. To minimize double counting of those who fall within both these categories (for example, employed in a creative occupation with a bachelor's degree), we ran a no-intercept regression with personal total earnings as a dependent variable and educational attainment and high-tech and creative occupations as independent variables. We used a five percent public-use microdata sample<sup>15</sup> from the 2000 Census of Population and Housing. Weights were assigned according to the regression coefficients (Appendix Table A1) as follows:

- no high school diploma – 10.4%
- high school graduate – 12.8%
- some college – 15.2%
- bachelor's degree – 22.0%
- graduate degree – 29.5%
- creative occupation – 7.9%
- high-tech occupation – 2.1%

## **STANDARDIZING INDICATORS AND FOUR INDICES OF HUMAN CAPITAL**

To calculate the indices of human capital and workforce, we used the median-score standardization.<sup>16</sup> This statistical technique standardizes variables based on a deviation from a median and creates the distribution of each indicator that is less skewed by the outliers compared to the traditional z-score standardization. For the Population Pipeline, Workforce

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<sup>15</sup> 3.5 million records of 2003 definition of MSAs.

<sup>16</sup> Edward W. Hill, Harold Wolman, Kimebrly Furdell, and Iryna Lendel (2005). "The Median Score and Index Creation." (Presented at the 35<sup>th</sup> Annual Meeting of the Urban Affairs Association, Salt Lake City, April 15, 2005).

Pipeline, and Workforce Utilization Indices, each indicator was standardized before the weights were applied and the indices were calculated. For the calculation of the Workforce Quality Index, the weights were applied to the percentages of population segments by educational attainment and high-tech and creative occupations. This standardization technique was applied to the final figures of the index.

After calculating the four indices as composites of weighted indicators, we scaled each index from 1.00 (the worst) to 10.00 (the best). The place given to each metro area by each of the four indices corresponds to its rank<sup>17</sup> among 36 metro areas. We included the three smaller metro areas of Northeast Ohio in the overall ranking, although we realize that smaller labor markets might be less attractive to creative and high-tech workers due to a weaker agglomeration effect.

We used the 2003 Office of Management and Budget's definition of Metropolitan Statistical Areas (MSAs) to calculate indicators using data estimates from 2000 to 2002. (The data sources are listed in Appendix E.) To calculate the four human capital indices, we did not include any indicators that represent change variables.

The following sections of this report look at the ranks of regions by all four indices and analyze metro areas by each of them in details. Appendices A, B, C, and D include an in-depth examination of each indicator incorporated in the calculation of the indices. All indicators are graphically depicted within the sample of the five highest-ranked and the five lowest-ranked metro areas, as well as some metro areas from the Midwest and Great Lakes region.

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<sup>17</sup> The rank is defined as non-ration position based on an index.

## **HUMAN CAPITAL AND WORKFORCE INDICES**

Following the framework described earlier, we ranked selected metropolitan statistical areas by four indices of human capital: Population Pipeline Index (PPI), Workforce Pipeline Index (WPI), Workforce Quality Index (WQI), and Workforce Utilization Index (WUI). We placed these four indices in the order of the human life cycle:

PPI [children and net-migrants] →

WPI [students and net-migrants — future workers] →

WQI [quality of existing workforce] →

WUI [utilization of existing workforce].

We analyzed metropolitan areas by the importance of each of these four indices:

WQI [quality of existing workforce] →

WPI [students and net-migrants — future workers] →

WUI [utilization of existing workforce] →

PPI [children and net-migrants].

Table 2 presents four scores and rankings for each metro area.<sup>18</sup> It shows that Austin scores the highest overall, placing in the top five metro areas in three indices. Moreover, Austin is ranked #1 in the two indices that are the most important for assessing regional human capital and workforce, workforce quality and workforce pipeline. Austin also ranks #3 in population pipeline and #8 in workforce utilization.

We consider Denver to be another successful metro area, with a consistently high ranking in all four indices: #3 in workforce quality, #7 in workforce pipeline, #8 in population pipeline, and #9 in workforce utilization. San Diego does not score among the top five in any of the four indices, but overall is high in all categories: #7 in workforce quality, #6 in workforce pipeline, #9 in population pipeline, and #10 in workforce utilization. Richmond, Charlotte, and Columbus are three other metro areas that are consistently in the upper half in all four indices.

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<sup>18</sup> With the exception of those that had no data for some variables of the Workforce Pipeline Index.

**Table 2. Ranking of Metropolitan Statistical Areas Based on Human Capital Indices**

Metropolitan Statistical Area	Population Pipeline Index <sup>a</sup>		Workforce Pipeline Index <sup>b</sup>		Workforce Quality Index <sup>c</sup>		Workforce Utilization Index <sup>d</sup>	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Akron OH	3.23	27	3.50	16	5.61	21	5.37	14
Austin–Round Rock TX	7.70	3	10.00	1	10.00	1	6.30	8
Buffalo–Niagara Falls NY	1.00	36	1.67	28	6.05	16	2.94	31
Canton–Massillon OH	2.14	32	NA	NA	2.39	33	4.22	26
Charlotte–Gastonia–Concord NC-SC	6.36	5	4.87	8	6.36	13	4.62	21
Cincinnati–Middletown OH-KY-IN	3.90	22	2.73	21	5.62	19	6.65	7
<b>Cleveland–Elyria–Mentor OH</b>	<b>2.07</b>	<b>33</b>	<b>1.85</b>	<b>27</b>	<b>5.86</b>	<b>17</b>	<b>2.59</b>	<b>32</b>
Columbus OH	4.93	12	4.35	14	7.07	9	8.19	3
Denver–Aurora CO	5.39	8	5.29	7	9.42	3	6.10	9
Grand Rapids–Wyoming MI	4.58	15	NA	NA	5.42	25	4.27	24
Greensboro–High Point NC	3.95	20	3.05	18	4.80	27	3.49	29
Indianapolis IN	5.08	11	NA	NA	6.30	14	8.17	4
Jacksonville FL	4.63	14	NA	NA	4.63	29	4.96	16
Kansas City MO-KS	4.38	17	2.87	19	7.55	6	5.37	13
Las Vegas–Paradise NV	10.00	1	6.59	4	2.12	35	4.22	27
Louisville KY-IN	3.69	24	2.19	24	4.30	30	5.50	12
Memphis TN-MS-AR	4.73	13	2.57	22	4.12	32	4.96	17
Milwaukee–Waukesha–West Allis WI	2.67	30	2.25	23	7.11	8	4.78	19
Minneapolis–St. Paul–Bloomington MN-WI	4.42	16	2.86	20	9.74	2	10.00	1
Nashville–Davidson–Murfreesboro TN	5.13	10	3.92	15	5.53	22	8.44	2
Oklahoma City OK	7.34	4	7.42	3	5.48	24	7.09	6
Orlando–Kissimmee FL	8.73	2	8.16	2	5.61	20	5.31	15
Phoenix–Mesa–Scottsdale AZ	4.08	18	2.09	25	5.52	23	3.91	28
Pittsburgh PA	2.62	31	4.75	10	6.15	15	3.38	30
Portland–Vancouver–Beaverton OR-WA	3.91	21	2.00	26	7.58	5	1.49	35
Providence–New Bedford–Fall River RI-MA	3.17	28	4.63	11	4.91	26	4.72	20
Richmond VA	5.72	7	4.45	13	6.75	11	8.00	5
Riverside–San Bernardino–Ontario CA	5.89	6	4.50	12	1.00	36	2.06	34
Sacramento–Arden-Arcade–Roseville CA	4.04	19	5.94	5	6.81	10	4.88	18
San Antonio TX	3.69	25	NA	NA	4.18	31	4.24	25
San Diego–Carlsbad–San Marcos CA	5.28	9	5.63	6	7.51	7	5.84	10
Seattle–Tacoma–Bellevue WA	3.07	29	4.77	9	9.11	4	2.51	33
St. Louis MO-IL	3.68	26	1.24	29	6.60	12	4.54	23
Tampa–St. Petersburg–Clearwater FL	2.02	34	1.00	31	4.68	28	4.58	22
Virginia Beach–Norfolk–Newport News VA-NC	3.88	23	3.46	17	5.77	18	5.80	11
Youngstown–Warren–Boardman OH-PA	1.58	35	1.14	30	2.14	34	1.00	36

Note: The data on non-S&E and S&E students were not available for selected metro areas

<sup>a</sup> PPI is composed from the indicators of children aged 0-5 and total net migration

<sup>b</sup> WPI is composed from the indicators of students and net migration by educational attainment

<sup>c</sup> WQI is composed from the educational attainment of population and the employment of high-tech and creative occupations

<sup>d</sup> WUI is composed from the indicators of labor force participation rate and unemployment rate

Cleveland scores very low on three out of four indices and is the closest to the middle only in workforce quality (#17). Among the three smaller Northeast Ohio metro areas, only the Akron metro area shows some success. Akron is ranked within the upper half in workforce pipeline (#10) and workforce utilization (#14), but scores lower in the workforce quality (#21) and in population pipeline (#27). Youngstown has the worst ranking of all metro areas in our sample, scoring among the lowest five in all four indices.

The other Midwest metro areas are ranked very low in population pipeline and workforce utilization. In workforce quality, however, Minneapolis scores #2, Milwaukee #8, and Columbus #9. In workforce pipeline, Pittsburgh scores #10 — the highest of all Midwestern metro areas; Columbus is ranked #14 and Akron #16.

The following four sections provide a detailed analysis and the ranking of all 36 metro areas according to each of the four indicators.

## **WORKFORCE QUALITY INDEX**

The quality of the existing workforce reflects the current condition of a regional economy and immediate opportunities and challenges to sustain that economy. Austin is ranked #1 in the quality of its existing workforce. This overall ranking results from a #1 ranking in the number of people with graduate/professional and bachelor's degrees as a percentage of the total population, #2 in the number of employees in high-tech occupations, and #5 in the number of employees in creative occupations (Table 3). Accordingly, Austin scores among the lowest in the number of people with a high-school diploma (#35), number of people with some college/associate's degrees (#26), and the number of people with less than a high-school education (#20).

Led by the Austin metropolitan area (10.00), the top five areas in workforce quality include #2 Minneapolis (9.47), #3 Denver (9.42), #4 Seattle (9.11), and #5 Portland with a significantly lower index of 7.58 (Table 3).

The highest-ranked regions in the Workforce Quality Index all ranked high in graduate/professional degrees and bachelor's degrees, as well as in high-tech and creative occupations. The Minneapolis metro area, the highest-ranked Midwest region, is the second-highest ranked region overall. Minneapolis scores very high in the number of people with a graduate/professional degree (#5) (which has the highest weight in overall scoring), the number of people with a bachelor's degree (#2), the number of people in creative occupations (#3), and

Table 3. Workforce Quality Index

Metropolitan Statistical Area	Less than high school		High school		Some college/ associate's degrees		Bachelor's degrees		Graduate/ professional degrees		High-tech occupations		Creative occupations		Workforce Quality Index	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	Index	Rank
Austin–Round Rock TX	13.5	20	19.3	35	29.1	26	25.5	1	12.7	1	11.1	2	4.8	5	10.00	1
Minneapolis–St. Paul–Bloomington MN-WI	6.8	1	23.6	29	33.7	8	25.2	2	10.7	5	10.2	4	5.0	3	9.74	2
Denver–Aurora CO	11.8	11	20.7	34	31.4	19	24.5	3	11.6	2	10.7	3	4.7	6	9.42	3
Seattle–Tacoma–Bellevue WA	8.7	3	21.3	32	35.3	4	23.5	4	11.2	3	9.8	8	3.6	18	9.11	4
Portland–Vancouver–Beaverton OR-WA	10.8	7	22.4	30	36.1	2	20.7	7	9.9	8	9.4	15	3.5	23	7.58	5
Kansas City MO-KS	10.4	5	27.3	23	31.5	17	20.7	6	10.1	7	9.7	10	4.2	9	7.55	6
San Diego–Carlsbad–San Marcos CA	16.0	29	18.6	36	34.6	7	19.8	11	11.1	4	12.2	1	3.1	26	7.51	7
Milwaukee–Waukesha–West Allis WI	11.9	14	27.3	22	31.0	21	20.3	9	9.4	17	9.7	11	5.0	4	7.11	8
Columbus OH	11.6	8	29.7	11	28.2	29	20.7	8	9.8	11	9.8	9	4.1	11	7.07	9
Sacramento–Arden-Arcade–Roseville CA	13.4	19	20.9	33	37.5	1	18.9	14	9.3	18	10.0	6	3.9	15	6.81	10
Richmond VA	14.8	26	26.9	24	28.5	28	20.2	10	9.7	12	9.9	7	4.5	8	6.75	11
St. Louis MO-IL	11.8	10	28.3	17	32.3	16	17.8	19	9.9	9	8.2	27	4.6	7	6.60	12
Charlotte–Gastonia–Concord NC-SC	15.0	27	24.4	27	30.4	22	21.8	5	8.4	25	7.6	31	3.9	16	6.36	13
Indianapolis IN	12.8	17	30.7	8	27.7	31	19.4	12	9.5	15	8.9	18	4.0	12	6.30	14
Pittsburgh PA	8.7	2	36.7	3	27.1	34	17.6	21	9.9	10	10.2	5	3.1	28	6.15	15
Buffalo–Niagara Falls NY	10.6	6	30.3	9	32.6	14	15.9	29	10.5	6	8.4	24	2.6	31	6.05	16
<b>Cleveland–Elyria–Mentor OH</b>	<b>12.2</b>	<b>16</b>	<b>30.7</b>	<b>7</b>	<b>30.3</b>	<b>23</b>	<b>17.2</b>	<b>23</b>	<b>9.6</b>	<b>13</b>	<b>8.8</b>	<b>19</b>	<b>3.6</b>	<b>19</b>	<b>5.86</b>	<b>17</b>
Virginia Beach–Norfolk–Newport News VA-NC	11.8	12	27.4	21	35.6	3	16.3	27	8.8	20	9.0	17	3.9	14	5.77	18
Cincinnati–Middletown OH-KY-IN	13.1	18	31.9	6	27.9	30	17.8	18	9.4	16	9.3	16	3.1	27	5.62	19
Orlando–Kissimmee FL	14.5	24	26.3	25	32.5	15	18.7	15	8.0	27	8.0	29	4.2	10	5.61	20
Akron OH	10.2	4	33.9	4	29.2	25	17.9	17	8.8	19	8.7	20	2.9	29	5.61	21
Nashville–Davidson–Murfreesboro TN	15.5	28	29.0	14	27.7	32	19.2	13	8.7	22	8.7	21	3.5	20	5.53	22
Phoenix–Mesa–Scottsdale AZ	17.1	31	21.9	31	34.8	5	17.7	20	8.6	23	8.0	28	4.0	13	5.52	23
Oklahoma City OK	13.5	21	27.7	20	33.1	11	17.1	24	8.5	24	9.6	12	3.5	21	5.48	24
Grand Rapids–Wyoming MI	12.2	15	29.9	10	33.1	12	17.0	25	7.8	30	7.6	32	5.1	2	5.42	25
Providence–New Bedford–Fall River RI-MA	17.6	33	28.0	19	27.5	33	17.3	22	9.5	14	9.5	14	1.7	33	4.91	26
Greensboro–High Point NC	17.3	32	28.6	15	28.6	27	18.2	16	7.3	32	7.5	33	5.1	1	4.80	27
Tampa–St. Petersburg–Clearwater FL	14.7	25	28.3	16	32.7	13	16.4	26	7.9	29	7.9	30	3.3	25	4.68	28

**Human Capital and Workforce Indicators**

Metropolitan Statistical Area	Less than high school		High school		Some college/ associate's degrees		Bachelor's degrees		Graduate/ professional degrees		High-tech occupations		Creative occupations		Workforce Quality Index	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	Index	Rank
Jacksonville FL	13.7	22	29.1	13	33.7	9	16.2	28	7.3	31	8.3	26	3.7	17	4.63	29
Louisville KY-IN	14.3	23	32.6	5	30.0	24	14.4	32	8.7	21	8.3	25	2.8	30	4.30	30
San Antonio TX	19.6	35	25.6	26	31.5	18	15.1	31	8.2	26	9.6	13	3.5	22	4.18	31
Memphis TN-MS-AR	16.9	30	28.2	18	31.1	20	15.8	30	7.9	28	8.5	22	2.5	32	4.12	32
Canton–Massillon OH	11.9	13	41.8	2	26.7	36	13.0	33	6.5	33	7.4	34	1.7	35	2.39	33
Youngstown–Warren–Boardman OH-PA	11.8	9	42.5	1	27.1	35	12.7	34	6.0	34	8.5	23	1.6	36	2.14	34
Las Vegas–Paradise NV	19.2	34	29.2	12	33.6	10	12.1	35	5.9	35	5.4	36	3.4	24	2.12	35
Riverside–San Bernardino–Ontario CA	24.4	36	24.3	28	34.8	6	10.9	36	5.6	36	6.3	35	1.7	34	1.00	36

Note: Each indicator is measured as a percentage of total population aged 25-64 and a rank within the sample of 36 metro areas



the number of employees in high-tech occupations as a percentage of the population (#4). Minneapolis also scores the highest by having the least number of people with less than a high school diploma. A detailed analysis of each of the workforce quality indicators is provided in Appendix A.

Denver, the third-highest ranked area, does well in workforce quality because of its high score in the number of people with graduate/professional and bachelor's degrees (#2 and #3, respectively), the number of employees in high-tech occupations (#3), and the number of people in creative occupations (#6). Like Austin and Minneapolis, Denver scores low in the percentage of people with a high school education only (#34). Decisive in Seattle's high workforce quality ranking are the number of people with graduate/professional degrees (#3), the number of people with bachelor's and some college/associate's degrees (both #4), and in the number of employees in high-tech occupations (#8). Portland scores high in the quality of the existing workforce through a fairly even distribution of its educational attainment among all groups than by very high rank in any single indicator. It scored #7 in the number of people with a bachelor's degree, #8 in graduate/professional degrees, #15 in the number of employees in high-tech occupations, and #7 in people with less than a high school education. The exception was a high ranking in some college/associate's degree, in which it ranked #2.

The lowest Workforce Quality Index rankings were observed in #32 Memphis (4.12), #33 Canton (2.39), #34 Youngstown (2.14), #35 Las Vegas (2.12), and #36 Riverside (1.00).

Cleveland is in the middle at #17 (5.86). Among individual indicators, Cleveland's best rankings are in high school graduates (#7) and graduate/professional degrees (#13). Cleveland's lowest rankings are in some college/associate's degrees and bachelor's degrees (both #23). Such a low ranking in some college/associate's and bachelor's degrees reflects the lack of skilled employees who are critical for the implementation of technology-based economic development regional policies. Akron is ranked #21 with an overall index of 5.61, scoring #4 in both high school graduates and population with less than a high school degree. Akron's lowest rankings are in creative occupations (#29) and in some college/associate's degree (#25).

Besides Minneapolis, Milwaukee and Columbus are ranked the highest among Midwestern areas at #8 (7.11) and #9 (7.07), respectively. Indianapolis and Pittsburgh just beat Cleveland in the overall rankings (#14 and #15, respectively); Cincinnati scores #19.

Milwaukee (#8 with an index of 7.11) scores very high in the number of employees in creative occupations (#4), fairly high in the number of people with a bachelor's degree (#9), and employees in high-tech occupations (#11). Columbus (#9 with an index of 7.07) scores #8 in bachelor's degrees, #9 in high-tech occupations, and #11 in both graduate/professional degrees

and creative occupations. Indianapolis (6.30) and Pittsburgh (6.15) are ranked higher than Cleveland by overall score and are ranked moderately high in graduate/professional degrees, but low in some college/associate's degrees.

The presence of a sizable population with a bachelor's degree makes the largest contribution to a high score in the Workforce Quality Index.<sup>19</sup> According to the importance of these four indicators — bachelor's degrees, graduate/professional degrees, creative occupations, and high-tech occupations — a few other metro areas in Table 3 should be highlighted. Charlotte's #5 in bachelor's degrees earned this metro area an overall ranking of #13, even though the individual rankings of all other indicators vary between #16 in creative occupations and #31 in high-tech occupations. Greensboro's #1 and Grand Rapids' #2 rankings in creative occupations did not have enough power to bring them to higher overall positions and most likely reflect accidental high rankings in an individual indicator due to the small size of these metro areas. However, Milwaukee's #4 in creative occupations together with #9 in bachelor's degrees, #17 in graduate degrees, and #11 in high-tech occupations strongly suggest the solid quality of its existing workforce.

In the Quality of Workforce Indicator, Cleveland's highest rankings are in the number of people with a graduate/professional degree and people in high tech and creative occupations. It clearly underperforms in the share of population with bachelor's and associate's degrees. Several Midwestern metro areas are ranked higher than Cleveland in bachelor's degrees. Minneapolis takes the top position among all Midwestern metro areas in all indicators. At the other end of the spectrum, Youngstown and Canton ranked among the five lowest in the majority of indicators and in the overall Quality of Workforce Index.

## **WORKFORCE PIPELINE INDEX**

The Workforce Pipeline Index (WPI) characterizes the education sector of the regional economy and the potential workforce that might be employed locally if the economy is ready to absorb it. Together with workforce quality, these two indices are the most important characteristics of a regional economy upon which public policies in workforce development might be designed.

This indicator includes two groups of educational indicators, each with several variables:

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<sup>19</sup> The correlation between the bachelor's degree and the workforce quality index is 0.74; between the master's degree and the index is 0.58; between creative occupations and the index, 0.38; and between high-tech occupations and the index, is 0.30.

- Future regional workforce by educational attainment (normalized by size of workforce)
  - total number of high school graduates
  - total number of non-science and engineering (non-S&E) students in colleges and universities
  - total number of science and engineering (S&E) students in colleges and universities
  - total number of non-S&E PhD graduates
  - total number of S&E PhD graduates.
  
- Net migration by educational attainment (normalized by size of workforce)
  - net migration of people with some college/associate's degree
  - net migration of people with an undergraduate degree
  - net migration of people with a graduate degree.

The first cluster of indicators reflects the resource of human capital that is already in a metro area. The extent to which colleges and universities prepare students and award PhD degrees demonstrates, on one hand, the educational capacity of colleges and universities in a region and, on the other hand, characterizes the depth of the potential pool of highly educated workers who might be employed within the metro area in the near future. The S&E students and degrees<sup>20</sup> both characterize the science and technical capacity of the area's colleges and universities and describe the potential S&E regional labor pool, which is critical for innovation and technology-driven development. High school graduates represent potential students for local universities and colleges. These are individuals who have a greater tendency to stay within a metro area after graduation.

The second cluster of indicators, net migration of people by educational attainment, characterizes the stream of a labor force that migrates in or out of a metro area. This indicator cannot be explained unambiguously. With regard to structural changes in a regional economy, the net migration of a population with a certain educational attainment might drain or enlarge the existing workforce resource. If structural changes in a regional economy require a larger workforce, a positive net migration might help to sustain economic growth by increasing the labor pool. If structural changes in the regional economy require downsizing of the existing labor pool, like many economies in the Midwest, negative net migration might be a positive sign of balancing the resource side of a regional market to the present capacity of production. In both cases, whether the market is growing or declining, the size of the regional economy

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<sup>20</sup> According to the NSF survey, this category included the fields of study such as Engineering; Physical Sciences; Earth, Atmospheric, and Ocean Sciences; Mathematics/Computer Sciences; Biological/Agricultural Sciences; Psychology; and Social Sciences. For a detailed explanation of S&E and non-S&E fields of study, see <http://www.nsf.gov/statistics/nsf04311/pdf/sectc.pdf>.

matters. Large economies experience positive externalities of agglomeration that influence technology-based development. Substantial manufacturing specialization and a high density of different industries in the same location generate a significant pool of skilled and creative labor force. This density encourages creation and dissemination of knowledge and, therefore, triggers innovations and predetermines successful restructuring of the economy and inevitable economic growth.

Table 4 provides information on the Workforce Pipeline Index and its indicators and ranks 36 metropolitan areas by the overall index and by each individual indicator.

The top ranked metropolitan areas are Austin (#1 with score of 10.00), Orlando (#2, 8.16), Oklahoma City (#3, 7.42) Las Vegas (#4, 6.59), and Sacramento (#5, 5.94). These places are either home to large universities or have a comparably small workforce with high positive net migration to their areas.

Austin ranks the highest in total number of S&E students, PhD graduates in colleges/universities, non-S&E PhD graduates, and net migration of people with some college/associate's degree. It educates 0.63 percent of its workforce as S&E students, 0.052 percent as S&E PhD graduates, 0.037 percent as non-S&E PhD graduates, and brings in 8.6 percent of workers with some college/associate's degree from other regions. It also scores high in all other indicators: #3 in non-S&E students, #6 in net migration of people with an undergraduate degree, and #11 in net migration of people with a graduate degree.

Austin's high ranking in this index is influenced by two major assets, (1) the presence of the University of Texas at Austin (the largest University of Texas branch), and Southwest Texas State University and (2) the growth of two major industries, Information and Professional & Technical Services,<sup>21</sup> which create consistent demand for engineers and technicians. In Austin, these industries employ, on average, 50 percent more people than are employed in these industries nationwide. Such a high demand not only helps to utilize students prepared by local universities, but also drives the most educated labor force to migrate to this region.

Oklahoma City and Sacramento are among the top 12 in most of the student/graduates indicators; Oklahoma City also ranks very high in migration indicators. Oklahoma City (#3 in PPI with an index of 7.42) is also home to large educational institutions, Oklahoma City University and Oklahoma State University, and has an economy with large and growing sectors in the Information, Professional, and Technical Services, and Mining Industries. Besides ranking high in the number of non-S&E and S&E students, it scored #5 in both net migration of people with undergraduate and graduate degrees.

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<sup>21</sup> Source: <http://www.economictoolbox.geog.psu.edu>

Table 4. Workforce Pipeline Index

Metropolitan Statistical Area	High School graduates		Non-S&E students in Colleges/Universities		S&E students in Colleges/Universities		Non-S&E PhD graduates		S&E PhD graduates		Net migration of people with some college/associate's degrees		Net migration of people with undergraduate degree		Net migration of people with graduate degree		Workforce Pipeline Index	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	Index	Rank
Austin–Round Rock TX	1.58	24	14.84	3	0.63	1	0.037	1	0.052	1	8.60	1	1.88	6	0.54	11	10.00	1
Orlando–Kissimmee FL	1.47	30	10.06	19	0.23	18	0.007	16	0.005	25	4.54	3	4.47	1	2.09	1	8.16	2
Oklahoma City OK	1.93	6	13.65	4	0.36	7	0.014	9	0.013	12	1.12	12	2.57	5	1.21	5	7.42	3
Las Vegas–Paradise NV	1.28	34	7.97	31	0.08	29	0.004	23	0.001	30	8.05	2	2.75	3	1.36	2	6.59	4
Sacramento–Arden–Arcade–Roseville CA	2.02	5	15.02	2	0.33	10	0.007	19	0.032	3	0.21	20	0.48	20	0.19	16	5.94	5
San Diego–Carlsbad–San Marcos CA	1.87	9	16.32	1	0.28	14	0.006	20	0.020	8	-0.23	28	-0.04	25	-0.47	34	5.63	6
Denver–Aurora CO	1.51	27	9.24	26	0.51	3	0.011	12	0.029	5	2.88	4	2.73	4	0.78	6	5.29	7
Charlotte–Gastonia–Concord NC-SC	1.42	33	9.01	27	0.13	27	0.001	29	0.001	28	1.64	8	2.81	2	1.26	3	4.87	8
Seattle–Tacoma–Bellevue WA	1.60	22	11.01	12	0.25	16	0.011	11	0.020	9	2.21	5	1.09	13	0.45	12	4.77	9
Pittsburgh PA	1.88	8	10.41	16	0.42	5	0.016	8	0.028	6	1.15	11	1.67	7	0.70	8	4.75	10
Providence–New Bedford–Fall River RI-MA	1.47	31	13.24	5	0.32	11	0.003	25	0.006	24	0.25	19	0.54	18	-0.01	22	4.63	11
Riverside–San Bernardino–Ontario CA	2.25	1	11.89	10	0.09	28	0.003	26	0.007	21	1.32	10	0.49	19	0.20	15	4.50	12
Richmond VA	1.78	16	10.10	18	0.21	21	0.008	15	0.012	15	1.65	7	1.45	9	0.67	9	4.45	13
Columbus OH	1.64	21	12.52	8	0.42	6	0.024	2	0.038	2	1.54	9	0.09	23	-0.32	31	4.35	14
Nashville–Davidson–Murfreesboro TN	1.21	36	9.87	23	0.27	15	0.001	30	0.000	31	1.81	6	1.47	8	0.28	13	3.92	15
Akron OH	1.84	10	12.11	9	0.55	2	0.002	27	0.020	10	-0.11	27	-0.38	31	-0.15	26	3.50	16
Virginia Beach–Norfolk–Newport News VA-NC	1.89	7	12.90	6	0.29	13	0.007	18	0.011	16	-0.01	24	-0.64	34	-0.46	33	3.46	17
Greensboro–High Point NC	1.43	32	10.85	15	0.25	17	0.017	7	0.005	26	0.34	18	-0.09	26	0.14	18	3.05	18
Kansas City MO-KS	1.83	11	8.78	28	0.06	30	0.003	24	0.006	23	0.91	13	1.26	11	0.19	17	2.87	19
Minneapolis–St. Paul–Bloomington MN-WI	1.76	18	9.62	24	0.35	8	0.021	4	0.030	4	-0.05	25	0.82	15	0.09	20	2.86	20
Cincinnati–Middletown OH-KY-IN	1.67	19	10.19	17	0.20	22	0.010	13	0.016	11	0.35	17	0.17	22	-0.03	23	2.73	21
Memphis TN-MS-AR	1.48	29	9.96	21	0.30	12	0.013	10	0.010	18	0.07	21	0.37	21	-0.09	25	2.57	22
Milwaukee–Waukesha–West Allis WI	1.82	12	10.94	13	0.35	9	0.009	14	0.011	17	-1.17	34	-0.46	32	-0.21	29	2.25	23
Louisville KY-IN	1.55	25	8.68	30	0.22	20	0.017	6	0.009	20	0.42	16	0.69	17	0.00	21	2.19	24
Phoenix–Mesa–Scottsdale AZ	1.66	20	11.24	11	0.20	23	0.007	17	0.010	19	-0.76	32	-0.63	33	-0.52	35	2.09	25

Metropolitan Statistical Area	High School graduates		Non-S&E students in Colleges/ Universities		S&E students in Colleges/ Universities		Non-S&E PhD graduates		S&E PhD graduates		Net migration of people with some college/ associate's degrees		Net migration of people with undergraduate degree		Net migration of people with graduate degree		Workforce Pipeline Index	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	Index	Rank
Portland–Vancouver–Beaverton OR-WA	1.58	23	9.89	22	0.14	26	0.001	31	0.004	27	0.01	23	-0.29	29	-0.17	27	2.00	26
<b>Cleveland–Elyria–Mentor OH</b>	<b>1.77</b>	<b>17</b>	<b>9.99</b>	<b>20</b>	<b>0.22</b>	<b>19</b>	<b>0.005</b>	<b>21</b>	<b>0.013</b>	<b>13</b>	<b>-0.65</b>	<b>31</b>	<b>-0.29</b>	<b>28</b>	<b>-0.27</b>	<b>30</b>	<b>1.85</b>	<b>27</b>
Buffalo–Niagara Falls NY	1.79	14	12.62	7	0.48	4	0.021	3	0.025	7	-1.42	35	-1.76	36	-1.23	36	1.67	28
St. Louis MO-IL	1.78	15	10.90	14	0.16	24	0.018	5	0.013	14	-7.41	36	0.94	14	0.59	10	1.24	29
Youngstown–Warren–Boardman OH-PA	2.18	3	9.60	25	0.06	31	0.001	28	0.000	36	-0.42	30	-1.17	35	-0.41	32	1.14	30
Tampa–St. Petersburg–Clearwater FL	1.27	35	8.72	29	0.14	25	0.005	22	0.006	22	-1.05	33	-0.22	27	-0.06	24	1.00	31
Canton–Massillon OH	2.06	4	NA	NA	NA	NA	0.000	33	0.000	32	-0.08	26	-0.30	30	-0.21	28	NA	NA
Grand Rapids–Wyoming MI	1.79	13	NA	NA	NA	NA	0.000	34	0.000	33	0.03	22	0.05	24	0.12	19	NA	NA
Indianapolis IN	1.54	26	NA	NA	NA	NA	0.000	32	0.000	34	0.79	15	0.81	16	0.21	14	NA	NA
Jacksonville FL	1.48	28	NA	NA	NA	NA	0.000	35	0.000	35	0.86	14	1.21	12	0.77	7	NA	NA
San Antonio TX	2.18	2	NA	NA	NA	NA	0.000	36	0.001	29	-0.26	29	1.27	10	1.23	4	NA	NA

Note: Each indicator is measured as a percentage of workforce and a rank within the sample of 36 metro areas

Unlike Oklahoma City, Sacramento (#5, index of 5.94) scored very high in total non-S&E students (#2) and total S&E PhD graduates, but ranks much lower in net migration of people with some college/associate's and undergraduate degrees (#20 in both) and net migration of people with a graduate degree (#16).

Orlando and Las Vegas score between #1 and #3 in all migration indicators. These metro areas attract the highest number of highly educated migrants, which drives their overall indices very high (# 2 and #4, respectively), despite the lower-than-average scores in the number of S&E and non-S&E students and PhD graduates.

Out of the 31 metro areas ranked by this index, Akron ranks #16, the highest in Northeast Ohio, with Cleveland at #27 and Youngstown at #30. Canton is not ranked in this index due to lack of data on the student population.

Cleveland has an overall index of 1.85, with its single highest ranking coming from total S&E PhD graduates (#13).<sup>22</sup> It scores very low in migration data (between #28 and #31), reflecting the prevailing out migration in all categories of migrants by educational attainment. Cleveland also scored relatively low in other student pipeline indicators (between #19 and #21).

Akron has the highest rank of all Northeast Ohio metro areas with an index of 3.5. It is the second-best (after Austin) in number of S&E students as a percentage of the workforce, #9 in non-S&E students, and #10 in S&E PhD graduates. Such high scores are influenced by the smaller size of this metro area and the presence of The University of Akron and Kent State University, both of which have large S&E departments.

Among Midwestern metro areas (graphs B1 through B4 in Appendix B), Pittsburgh ranks the highest, at #10 with an index of 4.75, which reflects its high position in total S&E students (#5), total S&E PhD graduates (#6), total non-E&S PhD graduates (#8), and positive net migration in all educational attainment categories. Columbus, with an overall ranking of #14 and an index of 4.35, scores #2 in non-S&E and S&E PhD graduates and #6 and #8 in S&E and non-S&E students, respectively.

All indicators of the Pipeline Workforce Index depict Midwest metro areas as those that still have an advantage in preparing students and PhDs, especially in science and engineering. However, these areas are losing that population to Eastern and Southern metro areas, which have ranked higher by in-migration and net migration by educational attainment.

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<sup>22</sup> Data of students and graduates in Cleveland MSA reflect the presence of Cleveland State University, Case University, and John Carroll University only.

In the long run, these dynamics might hurt the quality of the workforce in Midwestern metro areas and therefore might not support the desired restructuring of their economy by increasing their share of high-skill knowledge-intensive industries

## **WORKFORCE UTILIZATION INDEX**

The two previous indices describe the availability and quality of the current and future workforce. However, having a high-quality existing and prospective workforce tells only part of the regional human capital and workforce story. The other part is described by the successful utilization of the workforce, which shows how well a metropolitan economy engages its existing workforce in the production process. It reflects both the ability of the regional economy to absorb its workforce and the willingness of people to participate in the regional economy.

We used two indicators to describe the willingness of the population to participate in the existing regional economy and the ability of the current economy to utilize the existing workforce — labor force participation rate (LFPR) and unemployment rate, respectively.

Table 5 shows the 36 metro areas ranked by the overall Workforce Utilization Index, which includes the two indicators with equal weight.

Minneapolis ranks #1 (10.00) in the Workforce Utilization Index (WUI), a result of being #1 in the labor force participation rate (LFPR) and #5 in the unemployment rate (Appendix C, Figures C1 and C2). Nashville is ranked #2 (8.44) in WUI due to a #10 rank in LFPR and #2 in unemployment rate. In addition to Minneapolis, two more Midwestern metro areas, Columbus (8.19) and Indianapolis (8.17), are among the top five in this index. Columbus is ranked #3 (a combination of a #6 ranking in LFPR and #7 in unemployment). Indianapolis is #4, scoring at 8.17 (a result of being #5 in LFPR and #8 in unemployment). Finally, Richmond is ranked #5 (8.00), scoring #1 in unemployment, i.e., having the lowest unemployment rate, and #16 in LFPR.

Midwestern metro areas scored very differently in this index. Besides the three metro areas that are among top five in this index, Cincinnati scored 6.65, ranking #7. Akron and Milwaukee come in at 5.37 and 4.78, ranking #14 and #19, respectively. Canton (4.22) and Pittsburgh (3.38) rank #26 and #30, respectively. Cleveland (2.59) and Youngstown (1.00) bring up the rear, scoring among the lowest five metro areas in this index, #32 and #36, respectively; rounding out the bottom five are Seattle (#33), Riverside (#34), and Portland (#35).



Table 5. Workforce Utilization Index

Metropolitan Statistical Area	Labor Force Participation Rate		Unemployment Rate		Workforce Utilization Index	
	%	Rank	%	Rank	Index	Rank
Minneapolis–St. Paul–Bloomington MN-WI	74.3	1	4.3	5	10.00	1
Nashville–Davidson–Murfreesboro TN	68.5	10	4.1	2	8.44	2
Columbus OH	69.5	6	4.4	7	8.19	3
Indianapolis IN	69.7	5	4.5	8	8.17	4
Richmond VA	66.2	16	4.0	1	8.00	5
Oklahoma City OK	64.2	25	4.1	3	7.09	6
Cincinnati–Middletown OH-KY-IN	66.8	14	4.8	10	6.65	7
Austin–Round Rock TX	71.2	3	5.7	23	6.30	8
Denver–Aurora CO	71.6	2	5.9	26	6.10	9
San Diego–Carlsbad–San Marcos CA	60.9	31	4.3	6	5.84	10
Virginia Beach–Norfolk–Newport News VA-NC	60.2	32	4.2	4	5.80	11
Louisville KY-IN	65.8	18	5.2	12	5.50	12
Kansas City MO-KS	68.5	9	5.7	24	5.37	13
Akron OH	66.6	15	5.4	18	5.37	14
Orlando–Kissimmee FL	65.6	19	5.3	15	5.31	15
Jacksonville FL	64.5	23	5.3	14	4.96	16
Memphis TN-MS-AR	65.0	20	5.4	16	4.96	17
Sacramento–Arden-Arcade–Roseville CA	63.8	27	5.2	13	4.88	18
Milwaukee–Waukesha–West Allis WI	68.0	11	6.0	28	4.78	19
Providence–New Bedford–Fall River RI-MA	64.7	21	5.4	19	4.72	20
Charlotte–Gastonia–Concord NC-SC	70.1	4	6.4	31	4.62	21
Tampa–St. Petersburg–Clearwater FL	58.9	34	4.6	9	4.58	22
St. Louis MO-IL	66.0	17	5.8	25	4.54	23
Grand Rapids–Wyoming MI	68.7	8	6.3	30	4.27	24
San Antonio TX	61.1	30	5.1	11	4.24	25
Canton–Massillon OH	63.9	26	5.6	20	4.22	26
Las Vegas–Paradise NV	64.5	22	5.7	22	4.22	27
Phoenix–Mesa–Scottsdale AZ	63.4	28	5.7	21	3.91	28
Greensboro–High Point NC	68.0	12	6.6	34	3.49	29
Pittsburgh PA	60.1	33	5.4	17	3.38	30
Buffalo–Niagara Falls NY	62.4	29	6.0	29	2.94	31
<b>Cleveland–Elyria–Mentor OH</b>	<b>64.2</b>	<b>24</b>	<b>6.5</b>	<b>33</b>	<b>2.59</b>	<b>32</b>
Seattle–Tacoma–Bellevue WA	66.9	13	7.0	35	2.51	33
Riverside–San Bernardino–Ontario CA	58.7	36	5.9	27	2.06	34
Portland–Vancouver–Beaverton OR-WA	69.1	7	7.8	36	1.49	35
Youngstown–Warren–Boardman OH-PA	58.8	35	6.4	32	1.00	36

Of the top five ranked regions in the Workforce Quality Index, only Minneapolis ranked among the top five in the Workforce Utilization Index. Austin and Denver, leaders in Workforce Quality, ranked only #8 and #9 (index 6.30 and 6.10, respectively) in workforce utilization due to relatively high unemployment rates (5.7% and 5.9%). San Diego, another highly ranked area in Workforce Quality, has a comparably low labor force participation, ranking #31 with 60.9 percent. Lastly, Seattle and Portland (#4 and #5 in Workforce Quality) ranked among the lowest in the Workforce Utilization Index because of their high unemployment, placing #35 and #36, respectively.

## **POPULATION PIPELINE INDEX**

Overall population growth is determined by changes in births, deaths, and movement from region to region. Population trends affect the existing and prospective labor pools and, possibly, the pool of future students and graduates. However, those who are children today will not enter the labor force for another 15 or 20 years, therefore this index plays an important role in long-time regional vision and strategies. Children aged 0-5 as a percentage of total population combined with total net migration point to future population trends and thus to potential labor force and human capital.

An analysis of our sample of 36 metro areas shows that the variation in the number of children aged 0-5 as a percentage of total population is much lower than the variation of total net migration among our metro areas. Therefore, the Population Pipeline Index (PPI) ranking is influenced primarily by the migration indicator (Table 6).

Las Vegas, which ranked #1 in the PPI, has the second-highest total net migration aged 25+ as a percentage of total population with 22.57 percent. In our sample, Las Vegas' economy has the most secure future population and workforce flow. Its net migration is almost the same as Orlando's (#1, 22.63%), but Orlando is ranked much lower than Las Vegas in the number of children aged 0-5 as a percentage of total population (#29 versus #6). Austin, which ranked #3 in PPI, had a net migration of 13.6 percent (#4) and 7.45 percent of children aged 0-5 as a percentage of total population (#8). Oklahoma City and Charlotte, ranking #4 and #5 in PPI, were also high in total net migration (#3 and #6, respectively) and ranked #17 and #11 in percentage of children aged 0-5. (See the detailed analysis of both indicators in Appendix D).

Table 6. Population Pipeline Index

Metropolitan Statistical Area	Children aged 0-5 as a percentage of total population		Total net migration aged 25+ as a percent of total population aged 25+		Population Pipeline Index	
	%	Rank	%	Rank	Index	Rank
Las Vegas–Paradise NV	7.51	6	22.57	2	10.00	1
Orlando–Kissimmee FL	6.52	29	22.63	1	8.73	2
Austin–Round Rock TX	7.45	8	13.58	4	7.70	3
Oklahoma City OK	6.98	17	14.61	3	7.34	4
Charlotte–Gastonia–Concord NC-SC	7.18	11	9.55	6	6.36	5
Riverside–San Bernardino–Ontario CA	8.13	1	2.68	15	5.89	6
Richmond VA	6.46	30	10.76	5	5.72	7
Denver–Aurora CO	7.20	9	5.56	9	5.39	8
San Diego–Carlsbad–San Marcos CA	7.06	14	5.83	8	5.28	9
Nashville–Davidson–Murfreesboro TN	6.87	22	6.24	7	5.13	10
Indianapolis IN	7.49	7	2.79	14	5.08	11
Columbus OH	7.16	13	3.91	11	4.93	12
Memphis TN-MS-AR	7.60	4	0.82	21	4.73	13
Jacksonville FL	6.88	21	4.19	10	4.63	14
Grand Rapids–Wyoming MI	7.54	5	0.49	24	4.58	15
Minneapolis–St. Paul–Bloomington MN-WI	7.17	12	1.80	16	4.42	16
Kansas City MO-KS	7.19	10	1.54	19	4.38	17
Phoenix–Mesa–Scottsdale AZ	7.81	2	-2.93	30	4.08	18
Sacramento–Arden–Arcade–Roseville CA	6.94	19	1.44	20	4.04	19
Greensboro–High Point NC	6.56	26	3.10	12	3.95	20
Portland–Vancouver–Beaverton OR-WA	7.03	16	0.47	25	3.91	21
Cincinnati–Middletown OH-KY-IN	7.04	15	0.36	27	3.90	22
Virginia Beach–Norfolk–Newport News VA-NC	6.95	18	0.72	23	3.88	23
Louisville KY-IN	6.80	23	0.79	22	3.69	24
San Antonio TX	7.71	3	-4.00	34	3.69	25
St. Louis MO-IL	6.64	24	1.59	18	3.68	26
Akron OH	6.52	28	0.39	26	3.23	27
Providence–New Bedford–Fall River RI-MA	6.20	32	1.79	17	3.17	28
Seattle–Tacoma–Bellevue WA	6.53	27	-0.30	28	3.07	29
Milwaukee–Waukesha–West Allis WI	6.88	20	-3.77	33	2.67	30
Pittsburgh PA	5.55	36	3.01	13	2.62	31
Canton–Massillon OH	6.36	31	-3.20	31	2.14	32
<b>Cleveland–Elyria–Mentor OH</b>	<b>6.58</b>	<b>25</b>	<b>-4.66</b>	<b>35</b>	<b>2.07</b>	<b>33</b>
Tampa–St. Petersburg–Clearwater FL	5.75	35	-0.50	29	2.02	34
Youngstown–Warren–Boardman OH-PA	5.97	34	-3.45	32	1.58	35
Buffalo–Niagara Falls NY	6.07	33	-6.27	36	1.00	36

Among the five lowest-ranked PPI locations, Cleveland is #33 overall, due to a very low ranking in net migration (#35) and a slightly better ranking in children aged 0-5 (#25). In net migration, only Buffalo (-6.27%, #36) ranked lower than Cleveland's negative value of 4.66 percent. Canton (#32) and Youngstown (#35) are also among the five lowest ranked in PPI. Canton is ranked #31 in both indicators; Youngstown is ranked #34 in the percentage of children aged 0-5 and #32 in total net migration with a negative figure of 3.45 percent. The only non-Midwest metro area among the five worst in PPI is Tampa, Florida, with an overall ranking of #34, coming in at #35 in percentage of children aged 0-5 and #29 in total net migration, with a negative value of 0.5 percent.

The highest-ranked Northeast Ohio metro area is Akron (#27), which ranked #28 in percentage of children aged 0-5 and #26 in total net migration. Indianapolis is the highest ranked among the Midwest metro areas, placing #11 in overall PPI. It ranked #7 in percentage of children aged 0-5 and #14 in net migration with a positive figure of 2.79 percent. Indianapolis is followed by Columbus (#12), which ranked #13 in percentage of children aged 0-5 and #11 in total net migration with a positive figure of 3.91 percent. Minneapolis is ranked #16 in PPI, followed by Cincinnati (#22) and Louisville (#22). Pittsburgh just missed being in the bottom five, #31 overall, with the lowest percentage of children aged 0-5 in our sample (#36) and ranking 13th in total migration with a positive number of 3.01 percent.

## **APPENDIX A: INDICATORS FOR THE WORKFORCE QUALITY INDEX**

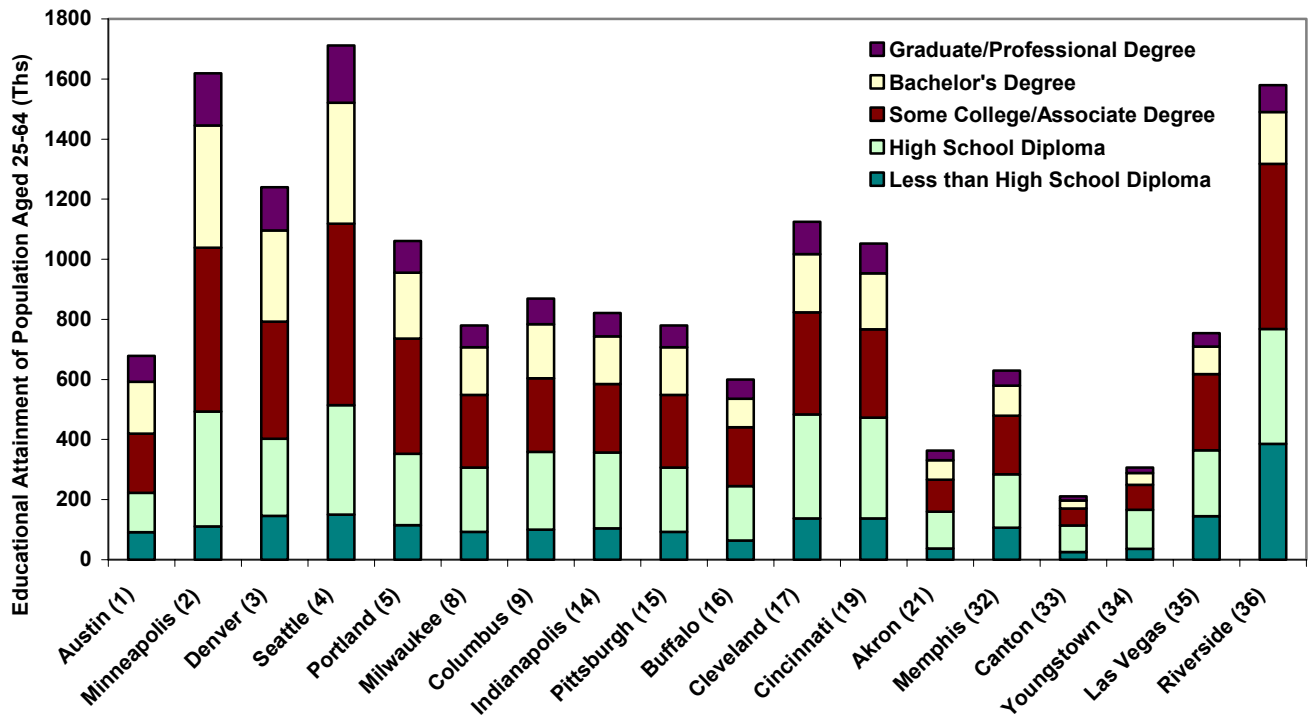
### **Educational Attainment**

An educated workforce is fundamental to supporting a vibrant regional economy; workforce educational attainment is the most important characteristic for assessing the Workforce Quality Index. We followed the U.S. Census Bureau's classification for the qualitative characteristics of a population's educational attainments, but unlike many studies, we assessed educational attainments for a population within the age bracket that characterizes the most active part of the regional workforce — population aged 25-64. The five variables used in this analysis are the number of people with less than a high school diploma, the number of people with a high school education, the number of people with some college/associate's degrees, the number of people with bachelor's degrees, and the number of people with graduate/professional degrees. All of these variables are normalized by the total number of population within the same age bracket (25-64 years old).

The data for this analysis are taken from the U.S. Census Bureau (Census 2000 summary file 3 – SF3) at the county level and aggregated to the metropolitan level by the 2003 definition of metro areas.

Figure A1 shows the structure of the 25-64 age cohort by educational attainment. The overall height of each bar reflects the total population aged 25-64 in each metro area.

Figure A1. Educational Attainment of People Aged 25-64 as a Percentage of Total Population Aged 25-64



The graph indicates that areas with high scores in the Workforce Quality Index have a large share of people with a bachelor’s degree or graduate education compared to the total size of their population. For example, the Austin metro area, which leads the overall index and the number of people with graduate/professional and bachelor’s degrees, is similar in population size to the Buffalo metro area. However, the total number and, therefore, share of the population with a bachelor’s or graduate/professional degrees in Austin are much larger, while the number and share of the population with some college/associate’s degree is about the same in both metro areas.

### People with Graduate or Professional Degrees as a Percentage of Population

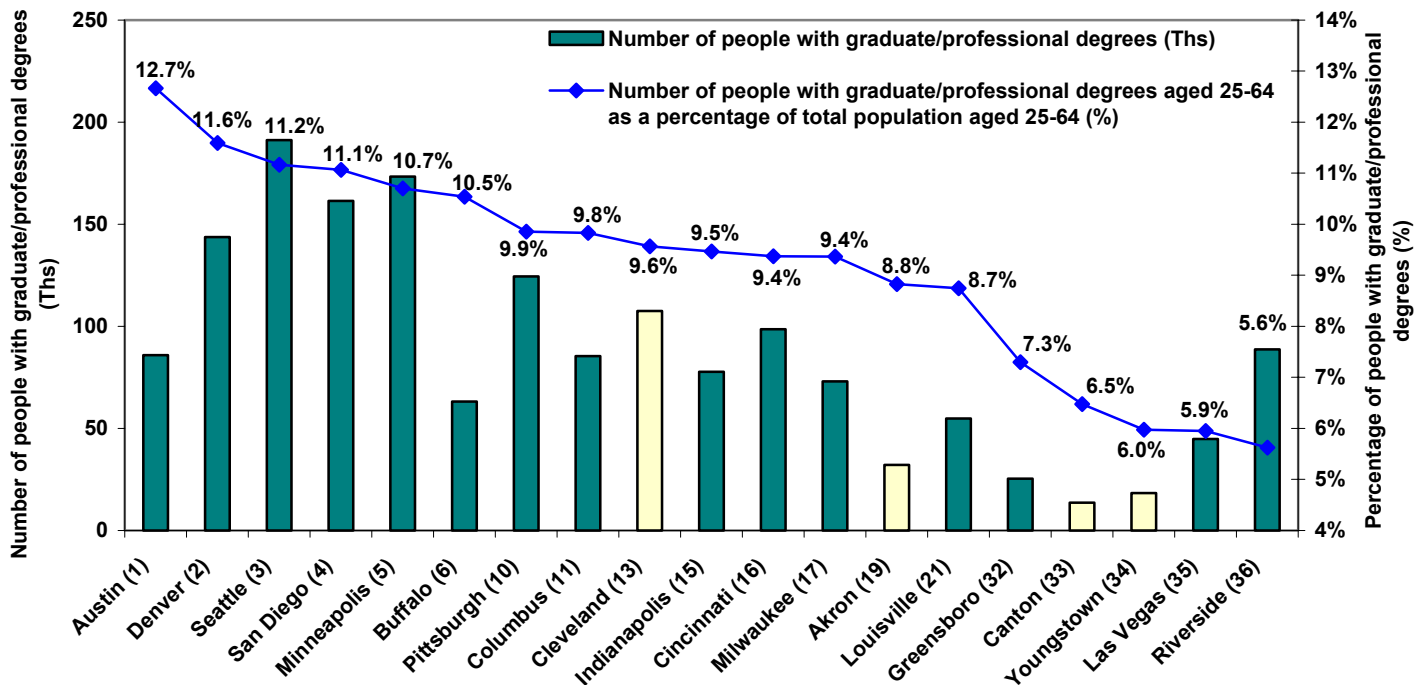
People with a graduate/professional degree add the most to the area’s personal income, therefore, this indicator has the highest weight in the overall index of workforce quality. Figure A2 shows the leading, lagging, and Midwest areas ranked by the percentage of the population with a graduate/professional degree and also shows the total number of the population aged 25-64 with such a degree.

Since this indicator has the highest weight in the overall index, the correlation between the number of people with a graduate/professional degree as a percentage of the population and the overall index is high. Four out of five leading areas in this category are also among the top five in the overall Workforce Quality Index. San Diego ranked #4 in this category, but dropped to #7 in the overall index due to its lower share in the bachelor's degree index.

Four of the five lowest-ranked metro areas in this indicator are also the five lowest ranked in the overall index. Greensboro ranked #28 in the number of people with a graduate/professional degree but ranked #32 in the overall index.

Among Midwestern metro areas, Minneapolis ranked the highest; coming at #5 with 10.7 percent of the population holding a graduate or professional education (173,308 people). In Pittsburgh (#10; 124,491 people) and Columbus (#11; 85,455 people), 9.9 and 9.8 percent of the population, respectively, have a graduate/professional degree, outpacing Cleveland (#13) with 9.6 percent and 107,547 people with a graduate/professional degree. However, relative to other indicators in the Workforce Quality Index, this is the one area in which Cleveland ranked the highest. Among the three smaller Northeast Ohio metro areas, Akron (#19) is the highest at 8.8 percent and 32,070 people. Canton (6.5%) and Youngstown (6.0%) ranked among the five lowest in this indicator, with respective ranks of #33 and #34.

Figure A2. Number and Percentage of People Aged 25-64 with Graduate/Professional Degrees



## People with a Bachelor’s Degree as a Percentage of Population

The number of people with a bachelor’s degree is the second-most influential indicator of personal income (regression coefficients in Table A1), and therefore has the second-highest weight in the Workforce Quality Index.

**Table A1. Regression Coefficients and Weights of Educational Attainments and Occupations in the Workforce Quality Index**

<b>Educational Attainment/Occupation</b>	<b>Regression Coefficient</b>	<b>Weight in the Workforce Quality Index</b>
No high school education	26,922	10.4%
High school education	32,976	12.8%
Some college/associate’s degree	39,279	15.2%
Bachelor’s degree	56,693	22.0%
Graduate degree	76,096	29.5%
Creative occupation	20,461	7.9%
High tech occupation	5,433	2.1%

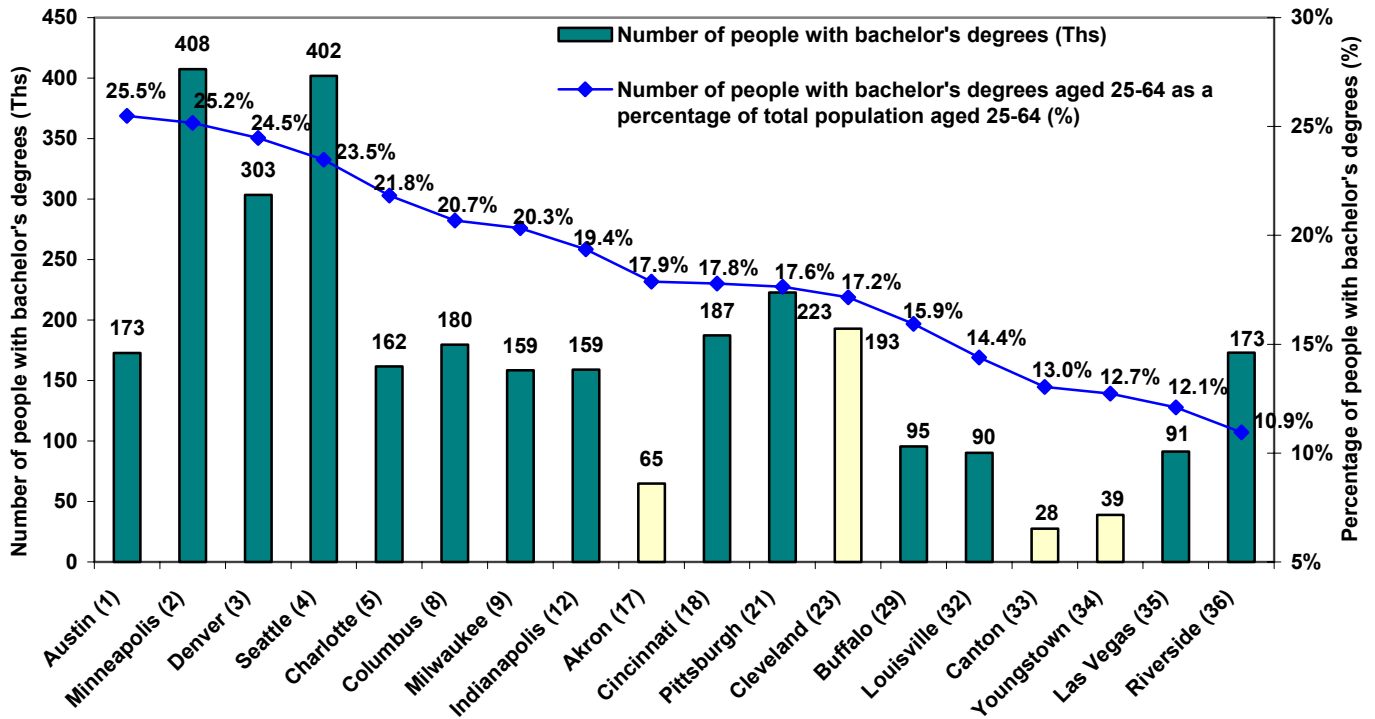
Figure A3 shows the number and percentage of people aged 25-64 with a bachelor’s degree in selected metro areas.

Austin (#1), Minneapolis (#2), Denver (#3), Seattle (#4), and Charlotte (#5) are the top five ranked areas, with percentages of people with a bachelor’s degree between 22 and 26 percent. Noticeably, among these five, three metro areas have populations aged 25-64 of 1.2 to 1.7 million. Two smaller metro areas, Austin and Charlotte, are comparable in size to Columbus (#8), Milwaukee (#9), and Indianapolis (#12), three Midwestern metro areas that scored within the upper half in this indicator.

Akron is ranked #18 with 17.9 percent of people with a bachelor’s degree, significantly outpacing two other smaller Northeast Ohio metro areas, Canton (#33 with 13.0%) and Youngstown (#34 with 12.7%). Cleveland is ranked #23 with 17.2 percent, just behind Pittsburgh (#21 with 17.6%) and outpacing Buffalo (#29 with 15.9%). The bottom five are rounded out by Riverside (#36 with 10.9%), Las Vegas (#35 with 12.1%), and Louisville (#32 with 14.4%).



Figure A3. Number and Percentage of People Aged 25-64 with Bachelor's Degrees

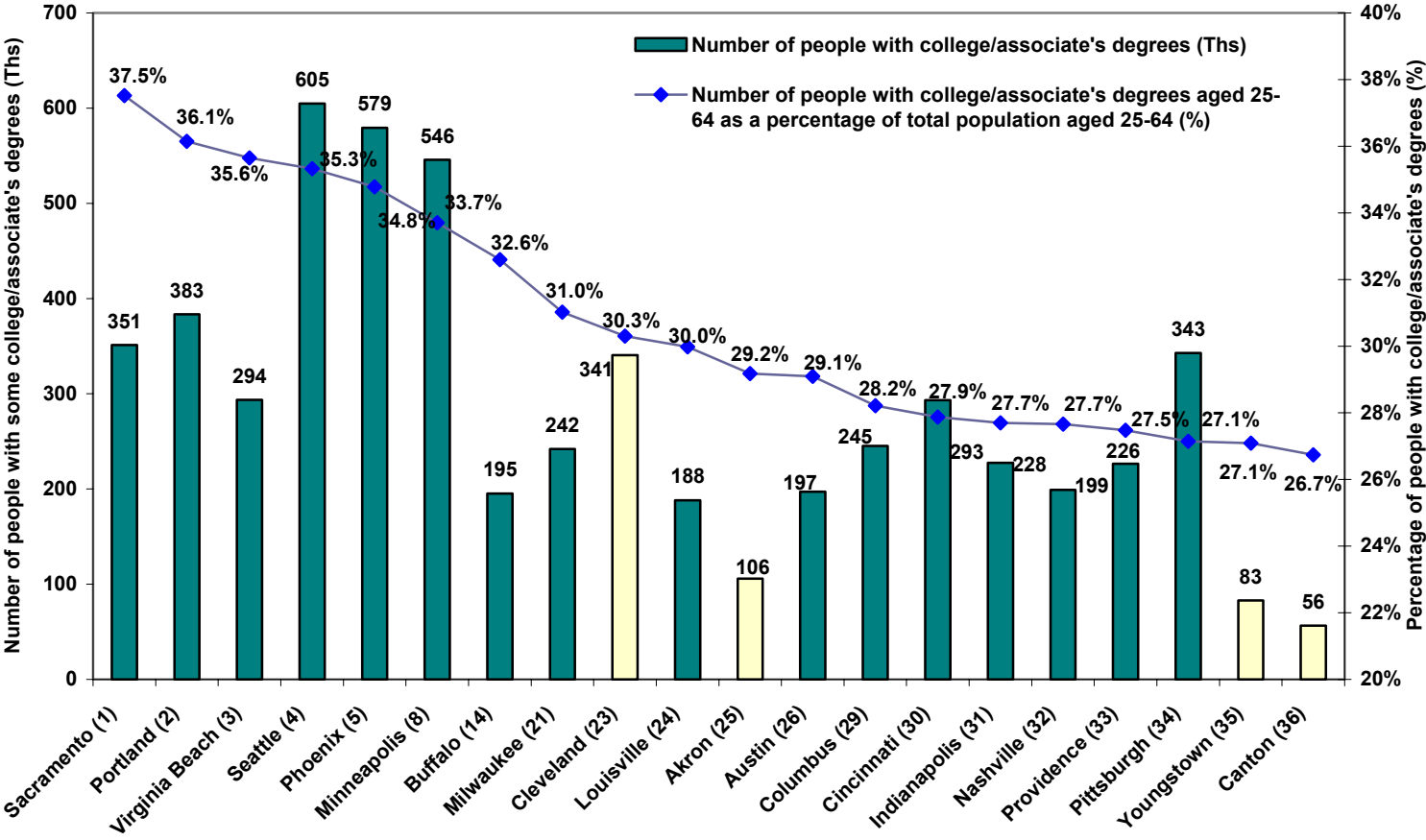


### People with Some College or Associate's Degrees as a Percentage of Population

Our data on different levels of educational attainment represent shares of the same total — population aged 25-64: higher shares of people with graduate/professional and bachelor's degrees imply lower shares of people with an associate's degree and high school education and vice versa.

As we can see in Figure A4, the top five areas with the highest percentage of population with some college/associate's degree are headed by three smaller metro areas — Sacramento (#1), Portland (#2), and Virginia Beach (#3). These are followed by five of the largest sample metro areas with the highest total number of people with this degree. Among those are: Seattle (#4, 35.3%) with 604,677 — the largest number of people in this category; Phoenix (#5, 34.8%) with 579,430 people; Riverside (#6, 34.8%) with 548,987 people; San Diego (#7, 34.6%) with 504,456; and Minneapolis (#8, 33.7%) with 545,724 people. Minneapolis is again the highest-ranked Midwest region.

Figure A4. Number and Percentage of People Aged 25-64 with Some College/Associate’s Degrees



Milwaukee (#21, 31.01%), Cleveland (#23, 30.3%), and Akron (#25, 29.18%) place among the second half of the list with Canton and Youngstown bringing up the rear at #36 and #35, respectively. Three other metro areas among the five lowest ranked are Pittsburgh (#34) 27.1 percent, Providence (#33) with 27.5 percent, and Nashville (#32) with 27.7 percent.

Seattle is the only metro area is the top five in all three indicators (number of people with a graduate/professional degree, number of people with a bachelor’s degree, and number of people with some college/associate’s degree). Austin, Minneapolis, and Denver were in the top five in two out of three of these indicators.

Only Canton and Youngstown were ranked among the lowest five in all three indicators, followed by Las Vegas and Riverside, which are ranked among the lowest five in two of the three indicators.

## **People in High Tech Occupations as a Percentage of Workforce**

High tech workers are essential to the creation of economic value by applying analytical skills to complex problems and creating innovative solutions. The share of employees who are high tech is very important to a region that aims for technology-based economic development. We used Daniel Hecker's definition of high-tech occupations, which is gaining broad-based support:<sup>23</sup> high-tech workers typically utilize new technologies in performing their work such that the results change the ways in which people live and work. These workers include engineers, life and physical scientists, mathematical specialists, engineering and science technicians, computer specialists, and engineering, scientific, and computer managers.

Since all high tech workers already fell within one of our educational categories, the coefficient of the income regression, which is the basis for the weight of this indicator in the Workforce Quality Index, represents the weight these workers have in addition to the main weight of their educational attainment.

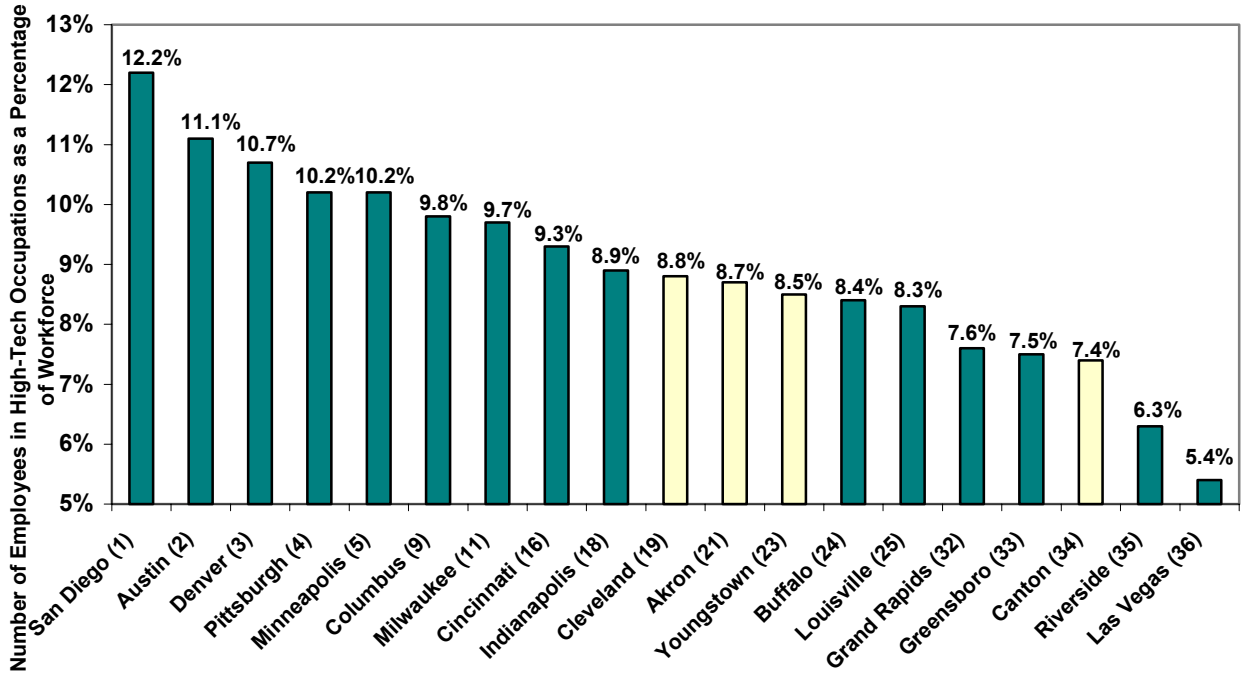
Figure A5 shows the number of high tech employees as a percentage of the workforce in metro areas with the highest and the lowest ranks in this indicator and Midwestern metro areas.

San Diego (#1) leads the list of metro areas with 12.2 percent high tech workers, followed by Austin (#2), Denver (#3), Pittsburgh (#4), and Minneapolis (#5). Due to large numbers of workers in the automotive industry and other manufacturing, many Midwestern metro areas ranked among the upper half in this indicator. Columbus (#9) and Milwaukee (#11) have 9.8 and 9.7 percent of high-tech workers, respectively, followed by Cincinnati (#16) with 9.3 percent and Indianapolis (#18) with 8.9%. Cleveland comes in below the 9.1 percent average, ranking #19 with 8.8 percent, followed by Akron (#21, 8.7%) and Youngstown (#23, 8.5%). Canton was among the five lowest ranked at #34 with 7.4 percent, joined by #36 Las Vegas (5.4%), #35 Riverside (6.3%), #33 Greensboro (7.5%), and #32 Grand Rapids (7.6%).

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<sup>23</sup> Hecker, Daniel (1999). "High Technology Employment: A Broader View," *Monthly Labor Review*. June, pp. 19-28.

Figure A5. People in High Tech Occupations as a Percentage of Workforce



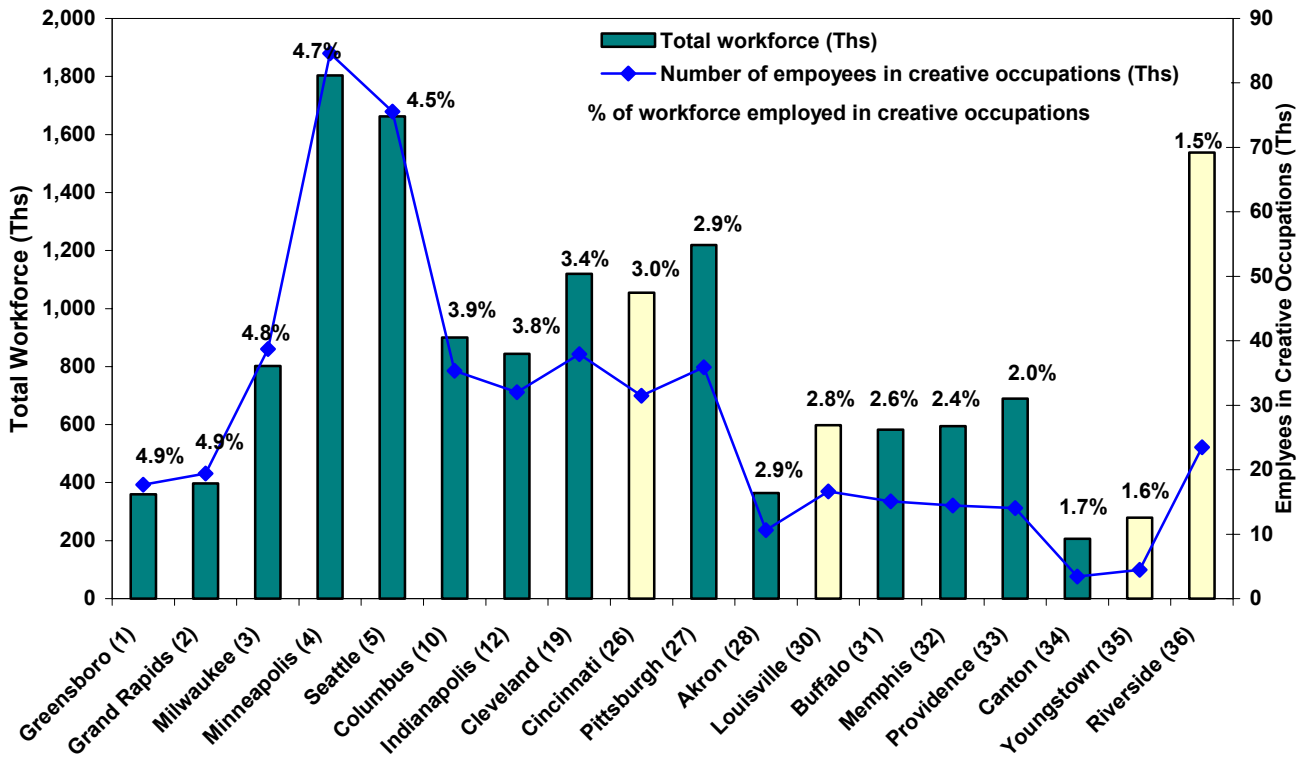
### People in Creative Occupations as a Percentage of Workforce

Another additional weight in the overall Workforce Quality Index applies to people working in creative occupations.<sup>24</sup> Designers, writers, engineers, and artists comprise the creative workforce, which likely produces technological innovation by bringing new ways of thinking to the region’s traditional industries.

The creative workforce in the studied metro areas varies from 1.5 percent in Riverside to 4.9 percent in Greensboro and Grand Rapids (Figure A6). Other metro areas that fall among the top five are Milwaukee (#3) with 4.8 percent, outpacing Columbus (#10, 4.4%), Indianapolis (#12, 3.9%), and Cleveland (#19, 3.8%). Cincinnati, Pittsburgh, Akron, Louisville, and Buffalo are ranked between #26 and #31 with percentages of workers in creative occupations between 2.6 and three percent.

<sup>24</sup> Our definition of creative occupations include actors; architects, except landscape and naval; art directors; arts, design, entertainment, sports, and media occupations; civil engineers; computer system analysts; credit analysts; editors; environmental engineers; environmental scientists and specialists, including health; floral designers; graphic designers; industrial designers; interior designers; lawyers; management analysts; market research analysts; mechanical engineers; producers and directors; training and development specialists; and writers and authors.

Figure A6. People in Creative Occupations as a Percentage of Workforce



The five lowest-ranked metro areas include two in Northeast Ohio, #34 Canton (1.7%) and #35 Youngstown (1.6%), rounded out by #36 Riverside (1.5%), #33 Providence (2.0%), and #32 Memphis (2.4%).

## **APPENDIX B: INDICATORS FOR THE WORKFORCE PIPELINE INDEX**

### **High School Graduates as a Percentage of Workforce**

Graduating from high school is an enormously important predictor of how students will fare later in life. High school graduates are almost twice as likely as dropouts to be gainfully employed.<sup>25</sup> Students who fail to graduate from high school are also significantly more likely to become single parents and have children at young ages. In addition, students who do not graduate from high school are significantly more likely to rely upon public assistance or be in prison.<sup>26</sup>

In the Workforce Pipeline Index, high school graduates<sup>27</sup> show the future stream of potential college-educated workforce with a lag of five to seven years. The weight of high school graduates in the overall WPI index is the smallest among all other indicators; however, high school graduates are still a significant asset to any metro area, as they are a future workforce that can be retained within the regional economy.

Figure B1 shows that the highest percentage of high school graduates normalized by regional workforce is in #1 Riverside (2.25%), #2 San Antonio (2.18%), #5 Sacramento (2.02%), and in two smaller Northeast Ohio metro areas, #3 Youngstown (2.18%) and #4 Canton (2.06%). The lowest percentage of high school graduates are in #32 Greensboro (1.43%), #33 Charlotte (1.42%), #34 Las Vegas (1.28%), #35 Tampa (1.27%), and #36 Nashville (1.21%).

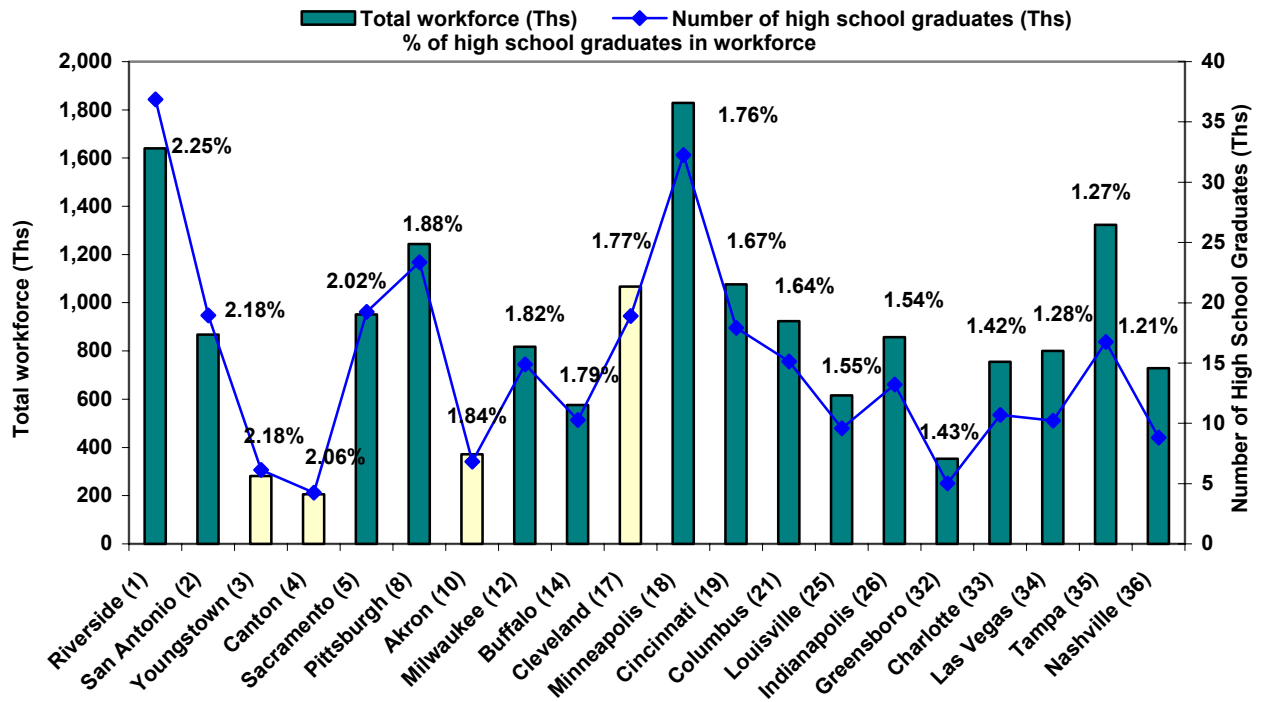
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<sup>25</sup> Educational Attainment — People 25 Years Old and Over, by Total Money Earnings in 1999, Work Experience in 1999. U.S. Census Bureau: comparing high school graduates and dropouts, [http://ferret.bls.census.gov/macro/032000/perinc/new03\\_001.htm](http://ferret.bls.census.gov/macro/032000/perinc/new03_001.htm)

<sup>26</sup> Kaufman, Phillip; Jin Y. Kwon; and Steve Klein (2000) *Dropout Rates in the United States: 1999*, National Center For Education Statistics, Statistical Analysis Report, November, p. 1.

<sup>27</sup> The number of high school graduates indicates the number of people, not limited but primarily age 16 to 21, graduating from high school in a given year. In contrast, one of the variables in the Workforce Quality Index, the number of people aged 25-64 with a high school education, indicates number of individuals 25-64 years old, with a high school diploma as their highest educational level.

Figure B1. Total Number and Percentage of High School Graduates



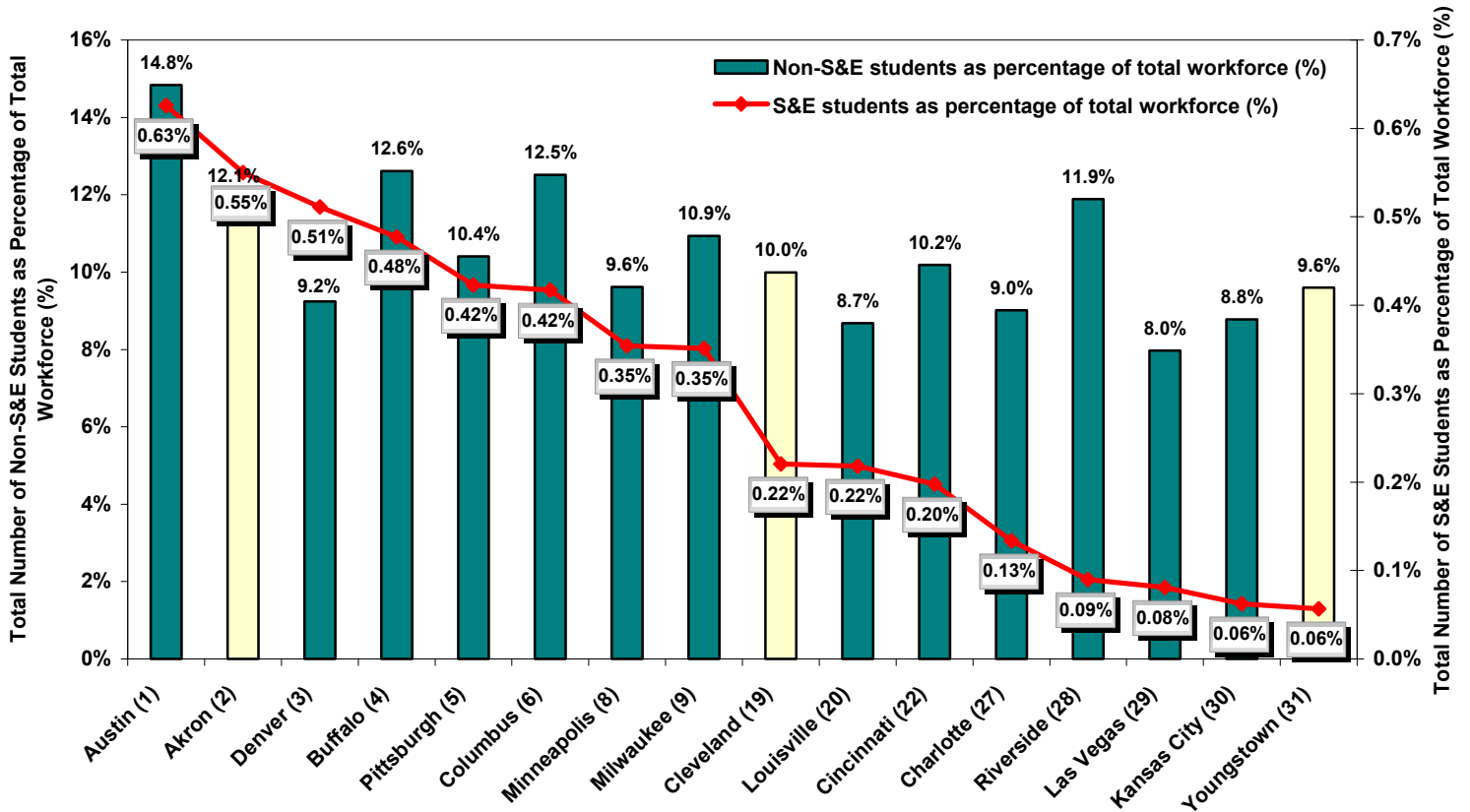
### Total Number of Non-S&E and S&E Students in Universities as a Percentage of Workforce

Students who study at local colleges and universities represent a resource to the future workforce that can be deployed in the regional economy. They can substitute for the existing workforce or be deployed by growing sectors of the regional economy; they may also increase the population’s educational attainment. This segment of the regional population is comprised of people who grew up locally or move to the region to attend school. They are already in the region and could be retained if the economy creates demand for additional workforce. In this report, we assume that today’s students will become tomorrow’s graduates and, in the near future, can become an important production factor that will benefit the local economy.

The data<sup>28</sup> for these two indicators, S&E and non-S&E students, are taken from two sources. The U.S. Census Bureau’s 2000 summary file 3 provides the total number of students at the county level who were matched to metropolitan areas using the 2003 definition of MSAs.

<sup>28</sup> The data of the number of non-S&E and S&E students were obtained and calculated from the National Science Foundation’s 2002 survey of colleges and universities. Many smaller, and /or non-research universities did not participate in this survey. Therefore, the data on these indicators represent a sample consistent with NSF’s pool of universities and do not completely reflect the total number of students in our metropolitan areas.

Figure B2. Total Number of Non-S&E and S&E Students in Colleges and Universities



The National Science Foundation’s survey of universities collects data on science and engineering students, which were matched with metropolitan areas by the university’s county affiliation<sup>29</sup>. Out of these data, we calculated S&E and non-S&E students and normalized them by the MSA workforce (Figure B2)

The highest percentage of science and engineering students are in #1 Austin (0.63%), followed by #2 Akron (0.55%), #3 Denver (0.51%), #4 Buffalo (0.51%), and #5 Pittsburgh (0.42%). Moreover, Pittsburgh (#5), Columbus (#6), Minneapolis (#8), and Milwaukee (#9) clearly show that the Midwest has kept its traditional lead in preparing the science and engineering workforce. Charlotte (#27), Riverside (#28), Las Vegas (#29), Kansas City (#30), and Youngstown (#31) have the smallest percentage of science and engineering students and in the near future can rely only on the migrating S&E workforce.

<sup>29</sup> S&E data are taken from the NSF website: TABLE 30. Graduate science students in all institutions, by region, state, institution, and citizenship, and by race/ethnicity background of U.S. citizens and permanent residents: 2002 and TABLE 31. Graduate engineering students in all institutions, by region, state, institution, and citizenship, and by race/ethnicity background of U.S. citizens and permanent residents: 2002 <http://www.nsf.gov/sbe/srs//nsf02314/sectb.htm>



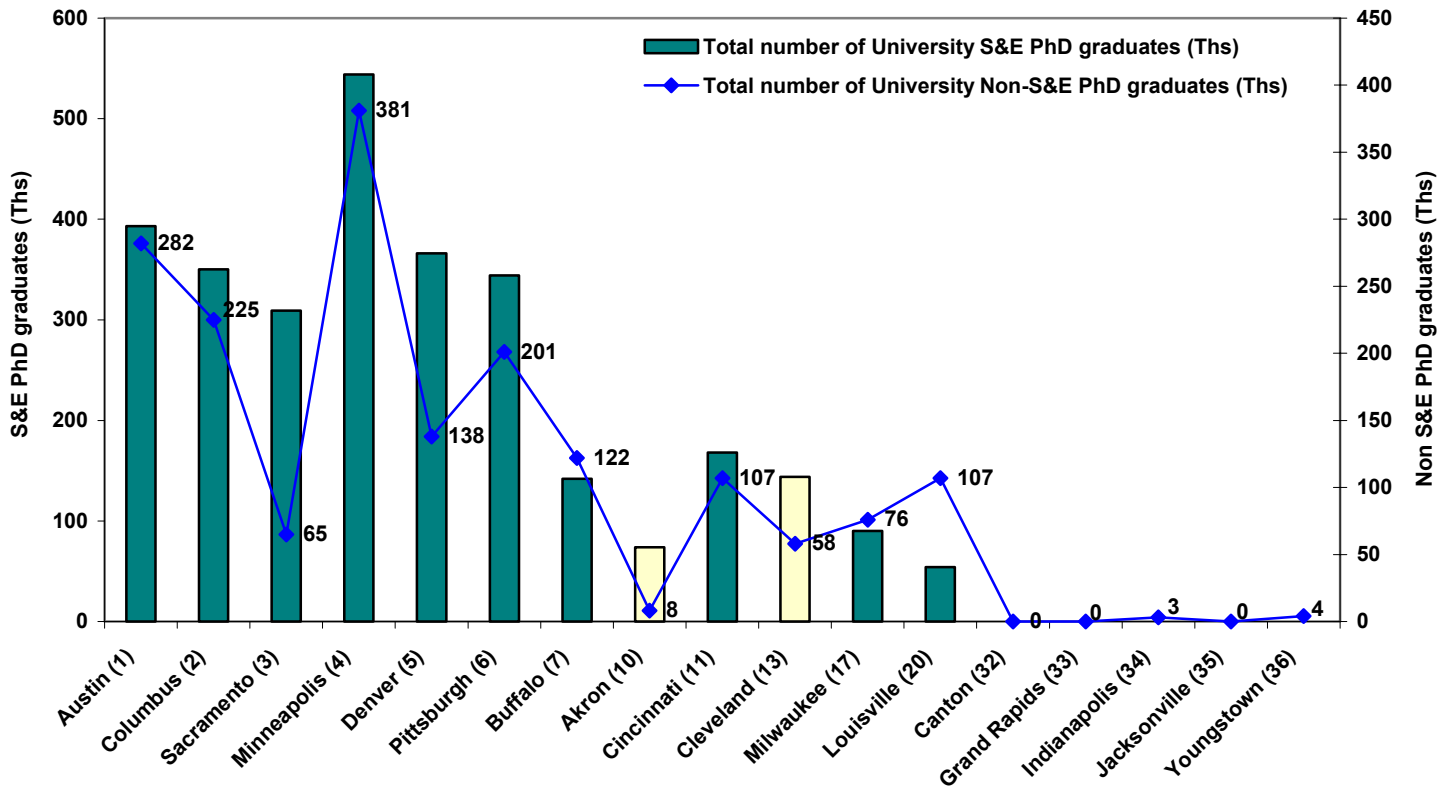
The highest percentages of non-S&E students are in San Diego (16.3%), Sacramento (15.0%), Austin (14.8%), Oklahoma City (13.6%), and Providence (13.2%) (Table 4). The lowest percentages of non-S&E students are in Las Vegas (8.0%), Louisville (8.7%), Tampa (8.7%), Kansas City (8.8%), and Charlotte (9.0%). Among Midwestern metro areas, Columbus ranked the highest (12.6%) followed by Akron (12.1%). The Cleveland metro area ranked #20 in this indicator (10%).

**Total Number of University PhD Graduates as Percentage of Workforce**

This variable indicates the percentage of highly skilled people in the region who, similarly to younger students, can be deployed within the regional economy. This category of the potential regional labor force is much harder to capture, as the increase in skills widens the scale of the market within which the labor force can be deployed. For PhD graduates in the majority of specializations, the scale of deployment is the national market.

Figure B3 shows the number of PhD graduates in non-S&E and S&E specializations.

**Figure B3. Total Number of S&E and Non-S&E PhD Graduates in Colleges and Universities**



Austin has the lead in S&E PhD graduates as a percentage of the total workforce (0.052%), followed by Columbus (0.038%), Sacramento (0.032%), Minneapolis (0.030%), and Denver (0.029%). Within our sample of metro areas, these places can be affiliated with universities that have large, high-quality S&E PhD programs and a technology lead within the regional economy. Pittsburgh (0.028%) and Buffalo (0.025%) rank #6 and #7, respectively, in this indicator. Akron comes in 10<sup>th</sup> with a percentage of S&E PhD graduates of 0.020. Cleveland is ranked #13 (0.013%), followed by Milwaukee (#17) and Louisville (#20). Four Midwestern metro areas were among the five lowest — #36 Youngstown, #34 Indianapolis, Grand Rapids (#33), and #32 Canton, joined by Jacksonville (#35).

In the ranking of non-S&E PhD graduates as a percentage of the workforce, Austin again takes the lead with 0.037%, followed by Columbus (0.024%), Buffalo (0.021%), Minneapolis (0.021%), and St. Louis (0.021%). The lowest percentage of non-S&E PhDs are in San Antonio, Jacksonville, Grand Rapids, Canton, and Indianapolis. Other Midwest metro areas were led by Louisville (#6), followed by Pittsburgh (#8), Cincinnati (#13), and Milwaukee (#14). Cleveland is ranked #21 with 0.005 percent of non-S&E PhD graduates; Akron and Youngstown score #27 and #28 with 0.002 and 0.001 percent, respectively.

### **Net Migration of Residents by Educational Attainment**

Another source of sustaining the regional labor force is inter-regional migration. We analyze net migration data assuming that all regions benefit from the in-migration of a highly educated workforce.

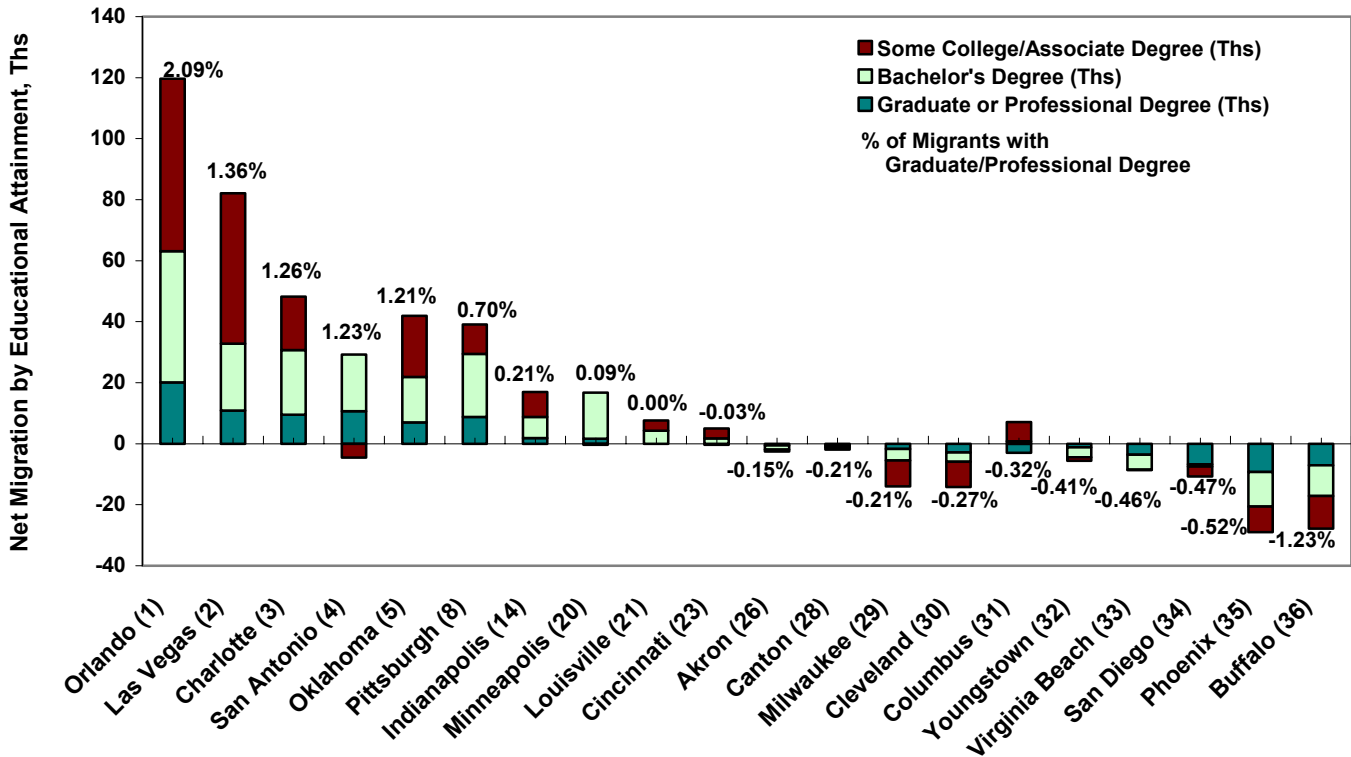
Overall, the total net migration for the metro areas from our sample vary from 12.45 percent of the workforce in Orlando to -4.84 percent in Buffalo. Besides Orlando, three other metro areas have significantly high positive net migration, these are Las Vegas (10.26%), Oklahoma City (7.25%), and Charlotte (6.39%). Negative total net migration was experienced by 12 metro areas from our sample, six of which are in the Midwest.

Analyzing only in-migration in relation to the size of the metro area's workforce points to three leading regions: Richmond (31.49%), San Antonio (23.88%), and Austin (16.72%). Regions with the highest absolute number of in-migrants include St. Louis (189,604), Minneapolis (149,487), Pittsburgh (140,016), and Riverside (121,054).

Figure B4 shows the structure of the migrating population aged 25 and over by educational attainment; metro areas are ranked by net migration of population with a graduate/professional degree as a percentage of the MSA's workforce. The largest percentage of net migration with graduate/professional degrees was recorded in Orlando (2.09%), Las

Vegas (1.36%), Charlotte (1.26%), San Antonio (1.23%), and Oklahoma City (1.21%). The highest absolute numbers of migrants with a graduate/professional degree were recorded in Orlando (42,241), San Antonio (41,067), St. Louis (39,104), Denver (33,883), and Minneapolis (28,958). Besides Minneapolis, other Midwestern regions that attract highly skilled populations are Pittsburgh (25,417), Cincinnati (17,675), Columbus (17,135), Cleveland (16,712), and Indianapolis (15,557).

Figure B4. Net Migration of Residents by Educational Attainment



Note: Metro areas are ranked by the net migration of people with a graduate/professional degree as a percentage of workforce

The highest percentage of migrants with an undergraduate degree as a percentage of the total workforce was in Orlando (4.47%), Charlotte (2.81%), Las Vegas (2.75%), Denver (2.73%), and Oklahoma City (2.57%). Leading metro areas by absolute number of in-migrants with an undergraduate degree are Orlando (87,970), Denver (81,861), San Antonio (78,995), Minneapolis (66,149), and St. Louis (65,779). Pittsburgh ranked #7 with 52,941 in-migrants with an undergraduate degree, while Columbus, Indianapolis, and Cincinnati ranked #16, #18, and #19, respectively, having between 32,000 and 35,000 in-migrants in this category and positive net migration in this category.

The Cleveland metro area has negative net migration in all educational categories, which is typical for an area that loses a large amount of its total population. For example, Cleveland had 28,703 in-migrants with an undergraduate degree, but at the same time lost 31,757 people in this category, resulting in a net loss of 3,054 bachelor's-level educated people (-0.29% of the workforce). Akron, Canton, and Youngstown also experienced negative net migration in all three educational categories.

Leading regions in positive net migration of people with some college/associate's degree are Austin, Las Vegas, Orlando, Denver, and Seattle. Austin also leads in the percentage of inflow of migrants with some college/associate's degree with 8.60 percent, followed by Las Vegas (8.05%), Orlando (4.54%), Denver (2.88%), and Seattle (2.21%). Ranking metro areas by absolute numbers in this indicator, Orlando leads with 56,527 migrants with some college/associate's degree, followed by Las Vegas (49,271), Seattle (29,218), Oklahoma City (20,038), and Austin (17,691).

The largest outflow of people with some college/associate's degree was experienced percentage-wise by St Louis (-7.41%), Buffalo (-1.42%), Milwaukee (-1.17%), Tampa (-1.05%), and Phoenix (-0.76%) and in absolute numbers by St. Louis (-20,844), Tampa (-13,901), Buffalo (-10,707), Milwaukee (-8,550), and Phoenix (-8,408). Cleveland ranks #31 both in absolute numbers (-8,254) and percentage (-0.65%) of outflow in this indicator. Youngstown, Akron, and Canton all lost more migrants with some college/associate's degrees than they gained from in-migration.

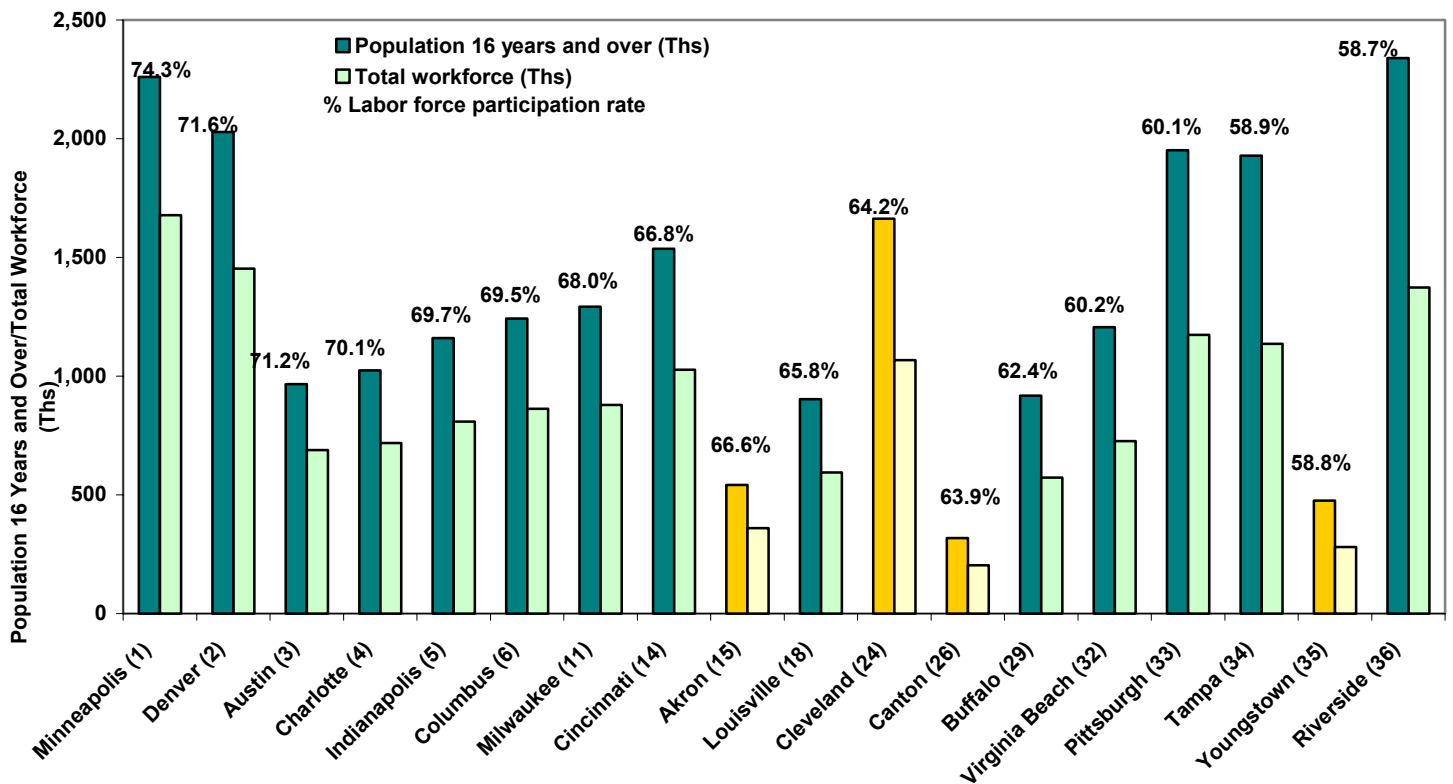
**APPENDIX C: INDICATORS FOR THE WORKFORCE UTILIZATION INDEX**

**Labor Force Participation Rate**

The labor force participation rate (LFPR) estimates the percentage of people who are working or actively seeking a job. A high LFPR is generally a sign of a healthy economy. A low LFPR means that large numbers of people are neither working nor looking for work, which suggests lack of employment opportunities or a high off-the-books employment presence. Both lack of employment opportunities and underground employment might inversely correlate with unemployment rate.

Figure C1 shows selected metro areas that have high and low LFPR, as well as Midwestern metro areas.

**Figure C1. Labor Force Participation Rate**



Minneapolis has the highest LFPR, ranking #1 with 74.3 percent. It is followed by #2 Denver with 71.6 percent, #3 Austin with 71.2 percent, #4 Charlotte with 70.1 percent, and #5 Indianapolis with 69.7 percent. Minneapolis and Denver represent larger metropolitan areas,

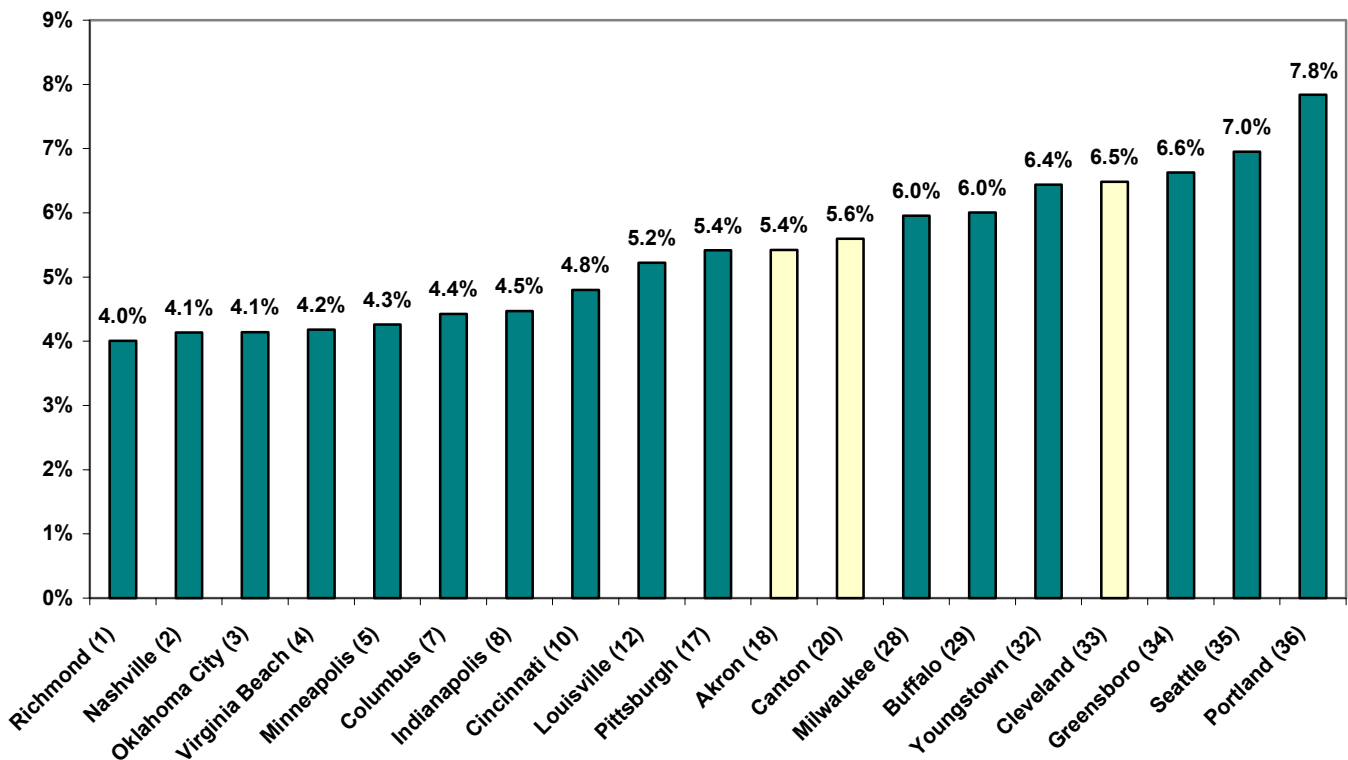
while Austin, Charlotte, and Indianapolis are more comparable in size to Midwestern metro areas that ranked high in this indicator. Columbus (#6) just missed the top five at 69.5 percent; Milwaukee (#11), Cincinnati (#14), Akron (#15), and Louisville (#18) ranked within the top half metro areas with a range of LFPR from 65.8 to 68.0 percent.

Cleveland ranked #24 with a LFPR of 64.2 percent, followed by Canton (#26) and Youngstown (#35). Besides Youngstown, the lowest-ranked metro areas were #36 Riverside (58.7%), #34 Tampa (58.8%), #33 Pittsburgh (60.1%), and #34 Virginia Beach (60.2%)

**Unemployment Rate**

The unemployment rate shows the percentage of the civilian labor force that is not employed but is currently seeking work. A higher unemployment rate results in a lower ranking. The unemployment rate is the highest in Portland (7.8%), which is joined among the lowest-ranked in this indicator by #35 Seattle (7.0%), #34 Greensboro (6.6%), #33 Cleveland (6.5%), and #32 Youngstown (6.4%) (Figure C2).

**Figure C2. Unemployment Rate**



The lowest unemployment rate is in Richmond (4.0%), Nashville and Oklahoma City (both 4.1%), and Virginia Beach and Minneapolis (4.2% and 4.3%, respectively).

Akron (#18) and Canton (#20) ranked in the middle, with 5.4 and 5.6 percent unemployment, respectively. The other Midwestern metro areas are scattered within a wide range of four to six percent unemployment.

## **APPENDIX D: INDICATORS FOR THE POPULATION PIPELINE INDEX**

### **Children Aged 0-5 as a Percentage of Total Population**

The number of children in the 0-5 age group represents the natality of a regional population. Healthy growth in this segment of the population might create stability in the regional future population and workforce.

Taken from the U.S. Census Bureau (Census 2000 summary file 1 – SF1), the data in Figure D1 show metropolitan areas with the five highest and five lowest rankings in terms of the percentages of children aged 0-5 in total population. The figure also shows other Midwest metro areas. The bars of the graph represent the total population of a metro area; the line of connected points represents the total number of children younger than five years of age. Figure F-1 also shows the percentages of this age group within the total population in each metro area.

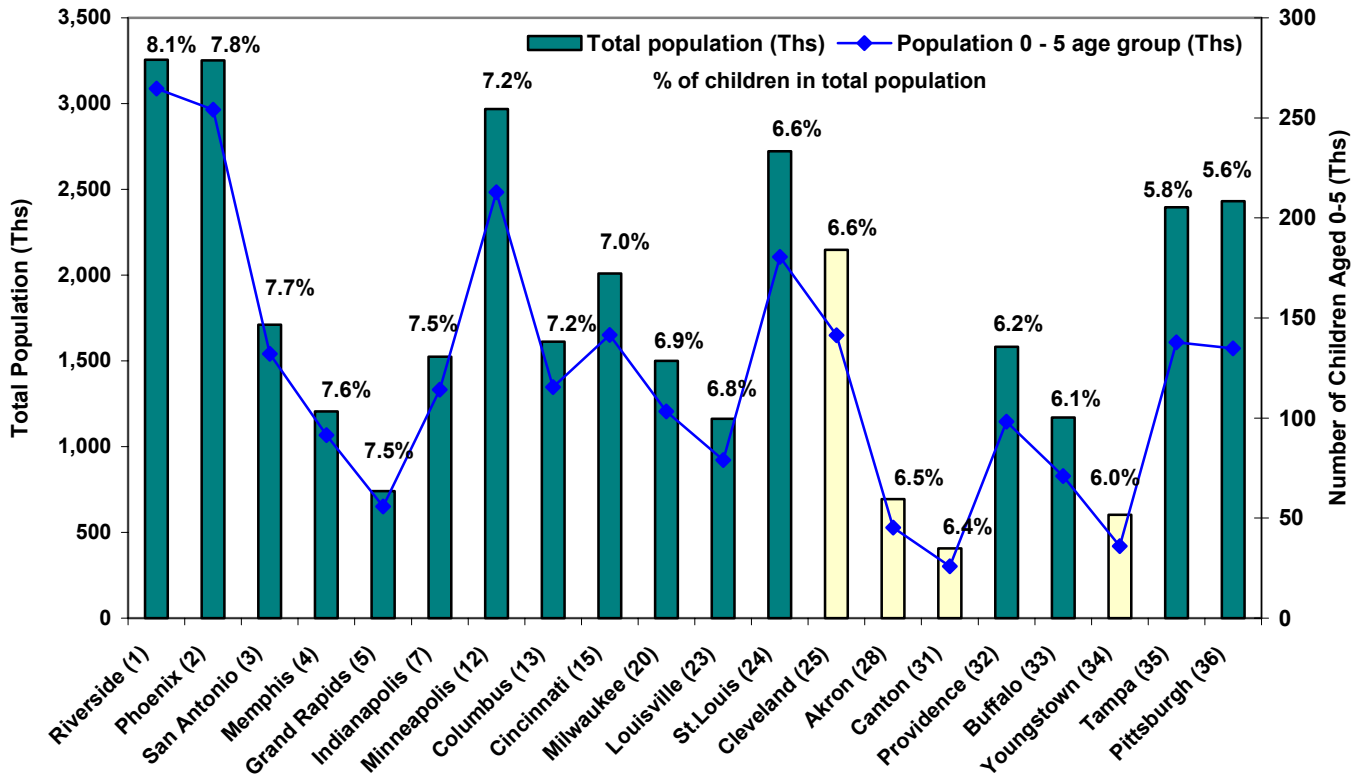
Overall, children aged 0-5 as a percentage of total population varies from 5.6 percent in Pittsburgh (#36) to 8.1 percent in Riverside (#1). Among the other top five metro areas in this indicator are Phoenix (#2) with 7.8 percent, San Antonio (#3), Memphis (#4), Grand Rapids (#5), and many others that scored between 7.7 and 7.5 percent, including Indianapolis (#7), which scored the highest among Midwest metro areas (7.49%). Minneapolis (#12), the largest Midwest metropolitan area, has 7.2 percent of its population below the age of five. St. Louis (#24) and Cleveland (#25) both have 6.6 percent.

Of the five metro areas with the lowest scores in this indicator, three were in the Midwest: Pittsburgh (#36) with 5.6 percent, Youngstown (#34) with six percent, and Buffalo (#33) with 6.1 percent. Tampa was #35 with 5.8 percent; and Providence (#32) was at 6.2 percent. Akron (#28) and Canton (#31) were almost at the same level as Cleveland, with 6.5 and 6.4 percent, respectively. This indicator helps decision-makers design long-term policies for future workforce and population needs.

Short-term changes in population and workforce depend on immigration from abroad and on migration patterns among regions. Since immigration patterns depend heavily on national and foreign policies, and because it makes up a very small portion of the regional workforce, the main source of critical changes in the current size and quality of the labor force is interregional migration



Figure D1. Total Number and Percentage of Population 0-5 Age Group in Total Population



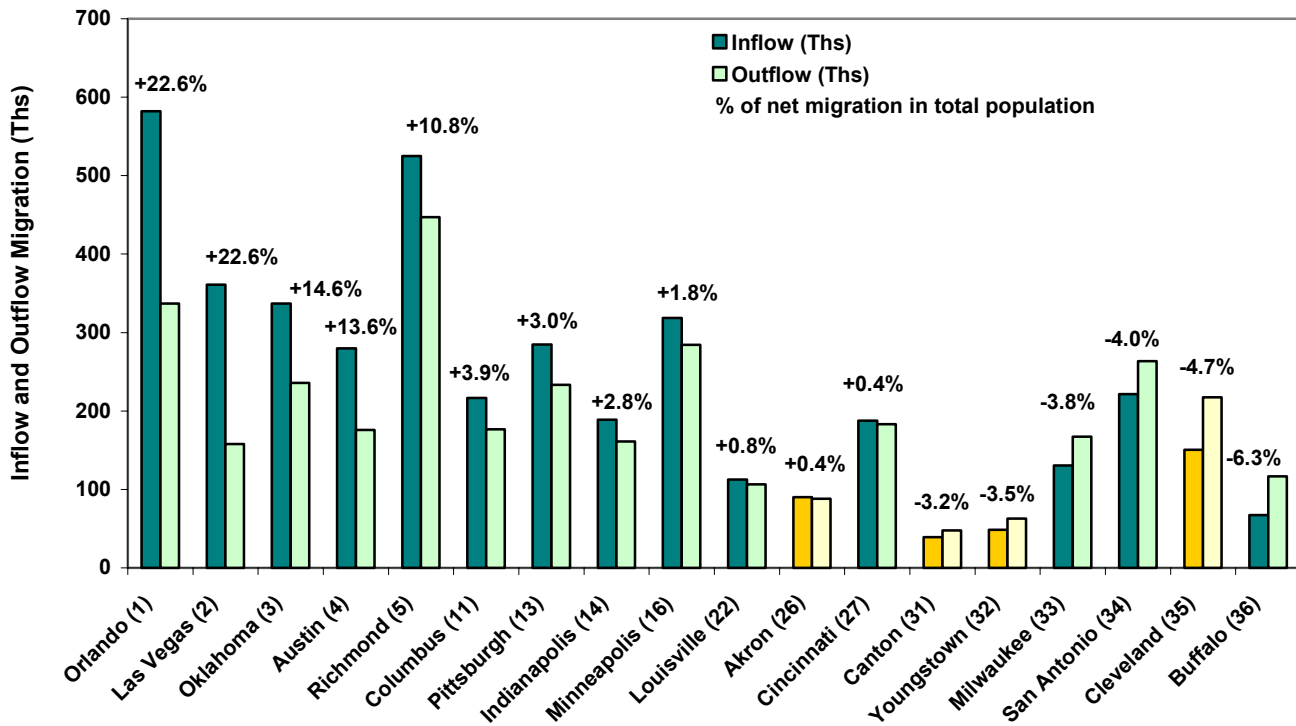
Note: The metro areas on a graph are ranked by the percentage of children aged 0-5 in total population

### Total Net Migration Aged 25 and Older as a Percentage of Total Population Aged 25 and Older

Domestic migration is becoming a critical source of population and labor force for economies that are changing from predominantly manufacturing to knowledge-intensive industries. Regions in transition compete for a very desirable segment of workforce — the well-educated workers who are highly mobile and have many choices as to where to work and live. A net gain of migrants is desirable because it contributes to the sustainability of the regional economy, expansion of the workforce, and creates the possibility of regional growth.

Figure D2 shows three variables that characterize regional migration: the inflow of population age 25 and older, the outflow of this segment of the population, and net migration as a percentage of total population age 25 and older.

Figure D2. Migration of Population Age 25 and Older as a Percentage of Total Population Age 25 and Older



The Orlando metro area (#1) scored the highest not only in percentage of net migration, but also in number of people moving into the metro area (582,206). Another metro area that scored high in these indicators was Richmond (#5), which has a net migration of 10.8 percent and population inflow of 525,099. Two larger metro areas with sizeable in-migration of people age 25 and older, Seattle (424,318) and St. Louis (411,570), are ranked #28 and #18, respectively, with Seattle having a negative net migration of -0.3 percent (Table 6). Las Vegas (#2), Oklahoma (#3), and Austin (#4) have very high percentages of net migration compared to their size and are very desirable destinations for relocation. In 2002, Las Vegas' in-migration reached 360,931, Oklahoma became home to 336,832 new residents, and the Austin metro area increased its population by 279,963. The Richmond metro area, #5 in net migration, was the second highest in absolute number of people coming in (525,099), followed by St. Louis (411,570), San Diego (394,574), and Denver (361,718). Among Midwestern areas, the highest inflow of people was in Minneapolis (318,485), Pittsburgh (284,530), and Columbus (216,762).

Unfortunately, all three Northeast Ohio metro areas ranked poorly on this indicator. Cleveland's negative net migration of -4.7 percent (-66,900) is the result of 150,504 people coming into and 217,404 people moving out of the metro area. The same negative population

change occurred in Buffalo (67,491 in and 116,730 out), ranking it at #36 with –6.3 percent net migration; San Antonio (221,335 in and 263, 445 out) scored #34 with –4.0 percent net migration, Milwaukee (130,563 in and 167,067 out), ranked #33 with –3.8 percent net migration, and Youngstown (48,631 in and 62,760 out), ranked #32 with –3.5 percent net migration. Canton followed the worst five and scored #31 with –3.2 percent net migration and 39,106 people in and 47,824 people out of the metro area.

Of the 36 metro areas, nine have negative net migration, seven are almost neutral with positive net migration of less than one percent, 11 have positive net migration of between one and six percent, and six metro areas have a positive net migration with double-digit numbers ranging from 10 to 23 percent.

While the overall the Population Pipeline Index and its indicators show the distant future for a metro area in terms of workforce quantity, the Workforce Pipeline Index and its indicators describe the immediate future of a metro area and its potential to keep the best-educated workers.

## **APPENDIX E: DATA SOURCES**

### **Children aged 0-5**

#### **Total population**

Census 2000 Summary File 1 (SF 1) – Population totals - Sex by age

[P12. SEX BY AGE \[49\] - Universe: Total population](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

#### **High school graduates**

Census 2000 Summary File 3 (SF 3) – College or Graduate School enrollment by age

[PCT24. SEX BY COLLEGE OR GRADUATE SCHOOL ENROLLMENT BY AGE FOR THE POPULATION 15 YEARS AND OVER \[23\] - Universe: Population 15 years and over](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

#### **Total number of students in universities**

Census 2000 Summary File 3 (SF 3) – College or Graduate School enrollment by age

[PCT24. SEX BY COLLEGE OR GRADUATE SCHOOL ENROLLMENT BY AGE FOR THE POPULATION 15 YEARS AND OVER \[23\] - Universe: Population 15 years and over](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

#### **Total number of S&E students in universities**

The National Science Foundation (NSF)

<http://www.nsf.gov/sbe>

TABLE 30. Graduate science students in all institutions, by region, state, institution, and citizenship, and by race/ethnicity background of U.S. citizens and permanent residents: 2002.

[www.nsf.gov/statistics/nsf05310/tables/tab30.xls](http://www.nsf.gov/statistics/nsf05310/tables/tab30.xls)

TABLE 31. Graduate engineering students in all institutions, by region, state, institution, and citizenship, and by race/ethnicity background of U.S. citizens and permanent residents: 2002.

[www.nsf.gov/statistics/nsf05310/tables/tab31.xls](http://www.nsf.gov/statistics/nsf05310/tables/tab31.xls)

#### **Total number of university PhD graduates**

National Center for Education Statistics (NCES) Digest of Education Statistics, 2003 TABLE 12.

Doctorates awarded, by state, institution, and major field: 2003

[http://nces.ed.gov/programs/digest/d03/list\\_tables.asp](http://nces.ed.gov/programs/digest/d03/list_tables.asp)

#### **Number of people with some college/associate's degree**

Census 2000 Summary File 3 (SF 3) – Educational attainment for 18 years and over

[PCT25. SEX BY AGE BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 18 YEARS AND OVER \[83\] - Universe: Population 18 years and over](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

#### **Number of people with undergraduate degree**

Census 2000 Summary File 3 (SF 3) – Educational attainment for 18 years and over

[PCT25. SEX BY AGE BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 18 YEARS AND OVER \[83\] - Universe: Population 18 years and over](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

#### **Number of people with graduate degree**

Census 2000 Summary File 3 (SF 3) – Educational attainment for 18 years and over

[PCT25. SEX BY AGE BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 18 YEARS AND OVER \[83\] - Universe: Population 18 years and over](#)

[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

**Number of people with PhD**

Census 2000 Summary File 3 (SF 3) – Educational attainment for 18 years and over  
[PCT25. SEX BY AGE BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 18 YEARS AND OVER \[83\] - Universe: Population 18 years and over](#)  
[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

**Number of employees in high-tech occupations**

U.S. Department of Labor, Bureau of Labor Statistics  
<http://www.bls.gov>

**Number of employees in creative occupations**

U.S. Department of Labor, Bureau of Labor Statistics: Occupational Employment Statistics (OES) Survey, May 2004 OES Estimates  
<http://www.stat.bls.gov/oes/home.htm>

**Total net migration aged 25 and over**

U.S. Census Bureau, Population Division  
Table 1: Migration for the Population 5 Years and Over for the United States, Regions, States, Counties, New England Minor Civil Divisions, and Metropolitan Areas: 2000  
<http://www.census.gov/population/www/cen2000/migration.html>

**Net migration of people with some college/associate's degree**

U.S. Census Bureau, Migration data division  
The data come from Census 2000 long-form data, and all mobility data are derived from the residence 5-years-ago question. All mobility data are for the population 5 years and over.  
<http://www.census.gov/population/www/cen2000/migration.html>

**Net migration of people with undergraduate degree**

U.S. Census Bureau, Migration data division  
The data come from Census 2000 long-form data, and all mobility data are derived from the residence 5-years-ago question. All mobility data are for the population 5 years and over.  
<http://www.census.gov/population/www/cen2000/migration.html>

**Net migration of people with graduate degree**

U.S. Census Bureau, Migration data division  
The data come from Census 2000 long-form data, and all mobility data are derived from the residence 5-years-ago question. All mobility data are for the population 5 years and over.  
<http://www.census.gov/population/www/cen2000/migration.html>

**Labor Force Participation Rate**

Census 2000 Summary File 3 (SF 3) – Employment and Unemployment status for the population 16 years and over  
[P43. SEX BY EMPLOYMENT STATUS FOR THE POPULATION 16 YEARS AND OVER \[15\] - Universe: Population 16 years and over](#)  
[http://factfinder.census.gov/servlet/DatasetMainPageServlet?\\_program=DEC&\\_lang=en&\\_ts](http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_lang=en&_ts)

**Unemployment rate**

U.S. Department of Labor, Bureau of Labor Statistics  
<http://www.bls.gov/lau/home.htm>