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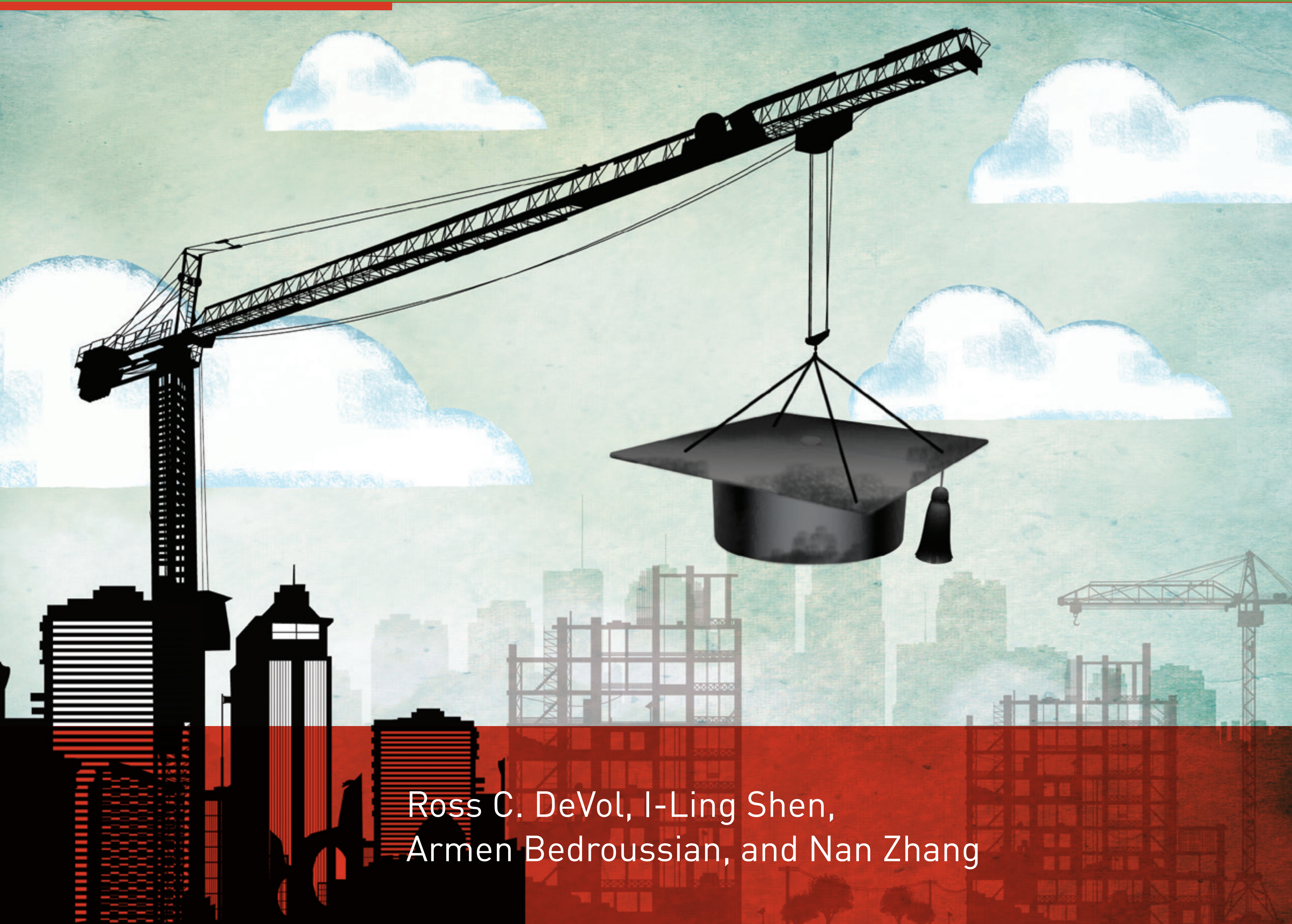
Milken Institute

A MATTER OF DEGREES:

The Effect of Educational Attainment on Regional Economic Prosperity



Ross C. DeVol, I-Ling Shen,
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OUR RESEARCH ON ECONOMIC PROSPERITY

We focus on:

Human capital: the talent, knowledge, and experience of people, and their value to organizations, economies, and society;

Financial capital: innovations that allocate financial resources efficiently, especially to those who ordinarily would not have access to them, but who can best use them to build companies, create jobs, accelerate lifesaving medical research, and solve long-standing social and economic problems; and

Social capital: the bonds of society that underlie economic advancement, including schools, health care, cultural institutions, and government services.

More than 40 years ago, Institute Chairman Michael Milken developed a formula for economic prosperity.

$$P = F_t\,(HC + + SC + RA)$$

It says that prosperity equals the effect of financial technologies acting as multiplier on the total value of human capital, social capital, and the real assets – cash, receivables, land, buildings, etc. – typically found on balance sheets.

By creating ways to spread the benefits of human, financial, and social capital to as many people as possible—the democratization of capital—we hope to contribute to prosperity and freedom in all corners of the globe.

ACKNOWLEDGMENTS

The authors appreciate the excellent suggestions and patience of our editor, Melissa Bauman, whose efforts vastly improved the quality of this report. This study was made possible through the support of the Apollo Group. The views expressed in this report, however, are solely those of the Milken Institute.

The Milken Institute would like to give special thanks to Apollo Group's Dr. Caroline Molina-Ray and Dr. Tracey Wilen-Daugenti for their valuable feedback, leadership, and vision in proposing and supporting this study aimed at investigating the value, importance, and future of education and its economic impact.

ABOUT THE MILKEN INSTITUTE

A nonprofit, nonpartisan economic think tank, the Milken Institute works to improve lives around the world by advancing innovative economic and policy solutions that create jobs, widen access to capital, and enhance health. We produce rigorous, independent economic research—and maximize its impact by convening global leaders from the worlds of business, finance, government, and philanthropy. By fostering collaboration between the public and private sectors, we transform great ideas into action.

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Data for each metro area can be found at ***www.matterofdegrees.net***

EXECUTIVE SUMMARY

What region wouldn't want to be the next Silicon Valley or Research Triangle? It's not an impossible goal with the right policies and investments in higher education. While it's intuitive that an educated population, good jobs, and prosperity go hand-in-hand, this study proves the strong relationship between educational attainment and a region's economic performance. The research is also original: We created a unique data set over time of educational attainment by occupation and industrial employment by occupation, which we linked together to examine these relationships, as measured by metropolitan statistical area (MSA) real wages and real gross domestic product (GDP) per capita. The purpose is to provide a blueprint for policymakers, educators, business executives, and civic leaders to follow in boosting education and skills training in their regions.

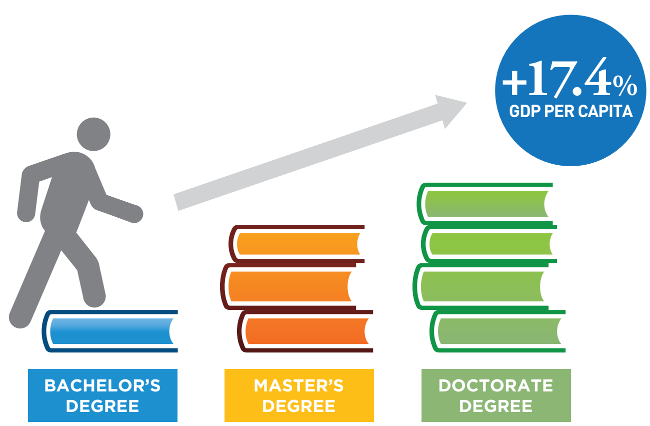
KEY FINDINGS

Our analysis clearly demonstrates that a region's economic fortunes are closely tied to the quality of its workforce. Our major findings are:

- **Education increases regional prosperity:** *Adding one extra year to the average years of schooling among the employed in a metropolitan area is associated with an increase in real GDP per capita of 10.5 percent and an increase in real wages per worker of 8.4 percent.* Take Danville, VA, for example. Average years of schooling in the metro rose 1.1 years to 13.18 from 1990 to 2010. This boosted real GDP per capita by 12.2 percent or $3,440.

- **Better educated, bigger benefits:** The benefits of additional schooling to regional economies are even greater for better-educated workers. *Adding one year of schooling to the average educational attainment among employed workers with at least a high school diploma is associated with an increase in real GDP per capita of 17.4 percent and an increase in real wages per worker of 17.8 percent.* In contrast, an additional year of education for workers with just nine or 10 years of schooling has little effect on real GDP per capita and real wages per worker.

Add one year of college to the region's workforce, and GDP per capita jumps **17.4%**



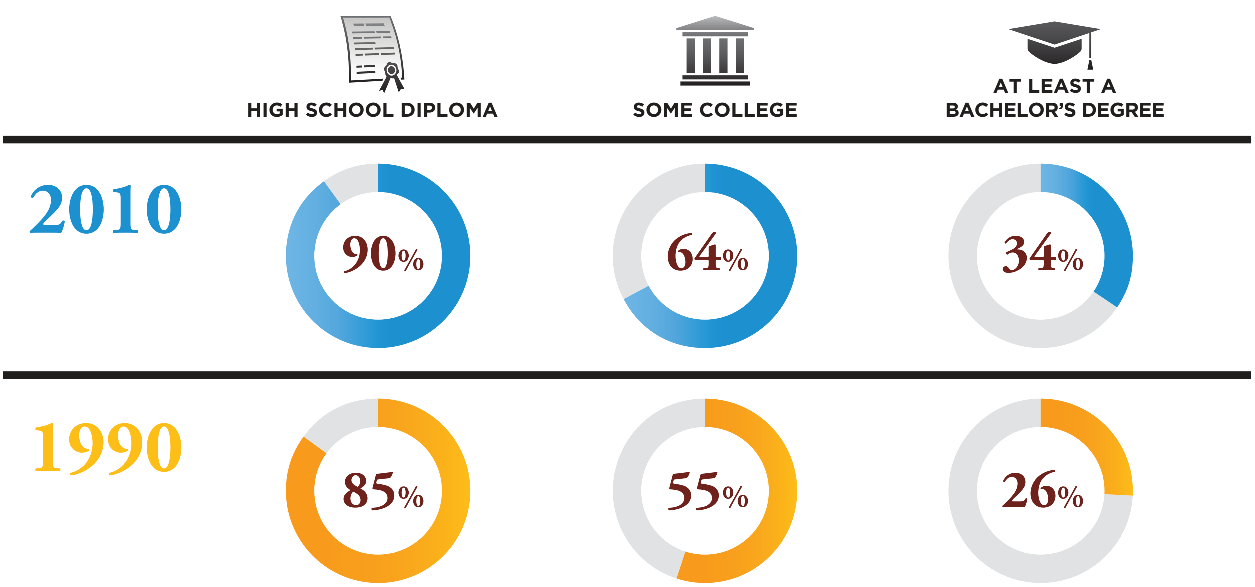
- **Certain industries lead to higher returns:** The returns to investment in education appear to be higher in some industries than in others. Given the same number of average years of schooling among the workforce, the returns to one more year of education are the greatest in metros with a large employment share of business and IT services industries, which involve high-skilled jobs.

- **Clusters count:** In metros with clusters of high-skilled occupations, the share of workers holding at least a master's degree is much higher than in metros without significant clusters, perhaps because of the intense competition for employment. In metros with clusters, we also found that skilled occupations are highly concentrated in a handful of industries. Combined, these findings demonstrate that a region's mix of industries contributes to differences in educational attainment within occupations.

HOW DOES EDUCATION DRIVE ECONOMIC PROSPERITY?

Controlling for other factors such as the age composition of the workforce, industry mix, R&D intensity as measured by patents per capita, and other structural differences, we were able to estimate the marginal rate of return of an additional year of schooling to the regional economy. The result? The overall explanatory power of the relationship is strong and robust. Over 70 percent of the variation in real GDP per capita across the 261 metros from 1990 to 2010 is explained. (For details about the methodology, see the full report.)

Education of the U.S. workforce



By 2010, 34 percent of the U.S. workforce held at least a bachelor's degree, a jump of 8 percentage points since 1990. However, other nations are closing the gap. Since 1980, the average years of schooling among Americans 15 and older increased by 1.1 years, to 13.1 years in 2010. Over the same period, other advanced economies gained 2.4 years, for 10.6 years of schooling.

POLICY RECOMMENDATIONS

Our findings provide a compelling argument for strategic investments in higher education to enhance regional economic competitiveness and, by extension, U.S. competitiveness overall.

Our **five key policy recommendations** for governments, educational institutions, and businesses include:

1. **MAKE HIGHER EDUCATION MORE AFFORDABLE.**
2. **MAKE HIGHER EDUCATION MORE ACCESSIBLE.**
3. **INCREASE HIGHER EDUCATION GRADUATION RATES.**
4. **STRENGTHEN COORDINATION BETWEEN HIGHER EDUCATION INSTITUTIONS AND INDUSTRIES.**
5. **PROMOTE RESEARCH AND DEVELOPMENT.**

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RESEARCH FINDINGS

When it comes to education, a rising tide really does lift all boats. It is also a location's most important source of sustainable competitive advantage.

It is conventional wisdom that an educated workforce is the key to a region's economic prosperity. It's why cities with excellent universities tend to have the most innovative companies. It's why local governments eager to expand their tax base compete to draw tech-based businesses and the highly skilled people they employ. It's why Northern California's Silicon Valley, North Carolina's Research Triangle, New York's Silicon Alley, and San Diego's Golden Triangle are the envy of every metropolitan area. But even if a region isn't a tech powerhouse yet, education helps protect it from being arbitraged by those seeking lower costs in a globally interconnected world.

Less conventional is the idea that just occupying the same geographic space as those skilled workers can benefit the less-educated workforce. As others around you obtain more education, their wages rise—and yours do, too. Their productivity also increases, as does yours. In other words, as educated workers improve their lot in life, they bring their neighbors along with them. Or in the language of economics: As educational inputs increase, economic output per capita rises more than proportionately. Our research demonstrates that for each additional year of post-secondary schooling a region's workforce obtains, real GDP per capita and real wages per worker jump by more than 17 percent.

That is just one of the findings to emerge from our study of the relationship between educational attainment and regional economic prosperity. The purpose of this study is to inform policymakers, educators, business executives, and civic leaders about the importance of boosting investment in education and skills training in their regions.

EDUCATIONAL ATTAINMENT IN THE U.S.

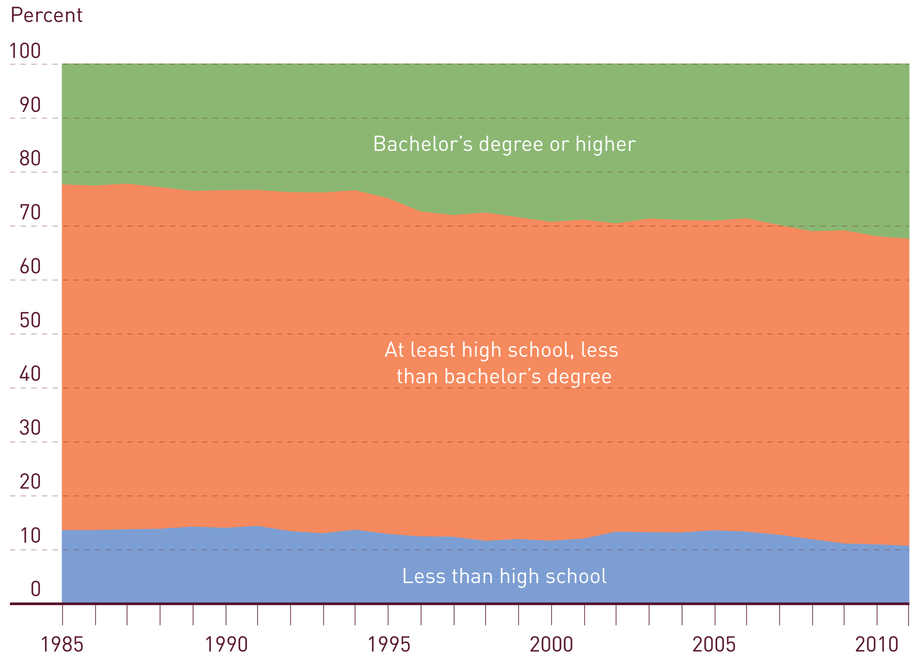
To learn how the dynamics of human capital are changing the paradigm of regional economic performance, we developed a data set of educational attainment among the workforce in U.S. metropolitan areas broken out by occupation for 1990, 2000 and 2010.[1] We used this data set to examine many facets of the statistical relationships linking the educational achievement of the workforce, a region's occupational and industry composition, and overall regional economic prosperity, measured as real GDP per capita and real wages per worker.

1. Our supplementary webtool (available at www.matterofdegrees.net) provides complete educational profiles for the 50 most populous metropolitan areas and for more than 300 occupations.

The percentage of Americans with at least a bachelor's degree has expanded rapidly in recent decades (see figure RF1), but other nations are catching up.[2] Since 1980, the average years of schooling among Americans 15 and older increased by 1.1 year, to 13.1 years in 2010. Meanwhile, other advanced economies gained 2.4 years, reaching 10.6 years of schooling over the same period.

FIGURE
RF 1

Educational attainment of young adults in the U.S.
Age 25-29, 1985-2010



Sources: Current Population Survey, National Center for Education Statistics.

EDUCATION AND REGIONAL PROSPERITY

Within the United States, there are vast geographic disparities in educational attainment (see figure RF2). Except for the District of Columbia, where almost half the population has a college degree, the majority of the best-educated states are concentrated in the Northeast. Massachusetts leads the states with 38.3 percent of adults having at least a bachelor's degree.

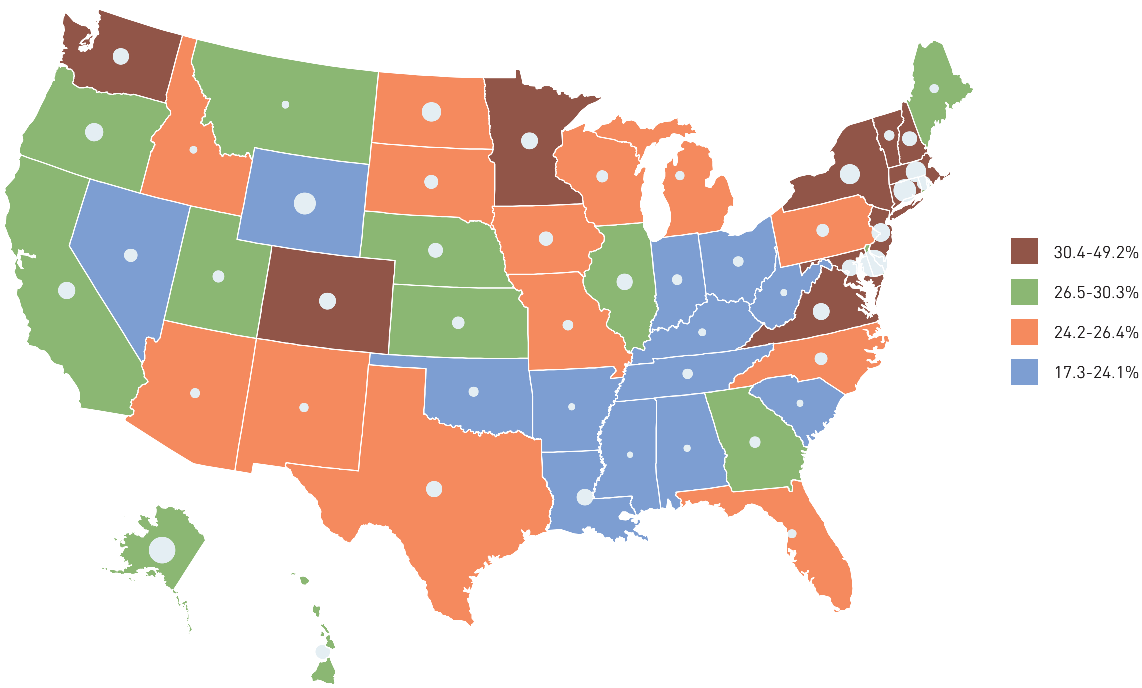
Conversely, the least-educated states are in the South; West Virginia is at the bottom of the pack with college graduates accounting for just 17.3 percent of the population.

2. Robert Barro and Jong-Wha Lee, "A New Data Set of Educational Attainment in the World, 1950-2010," NBER Working Paper No. 15902, 2010. The data set is available online at www.barrolee.com. Notice that the average years of schooling in this data set is constructed as the sum of duration to complete each level of education for each group that has completed primary, secondary, and tertiary education, respectively. Thus, the values are not comparable to other estimates based on different computation rules. For example, in 2000, the average years of schooling in the U.S. amounted to 12.7, according to the Barro and Lee computation; 13.5, according to Turner et al. (2006); and 13.3 across the metropolitan areas, based on our own estimation.

Most important for our purposes is the fact that the better-educated states generally have above-average real GDP per capita. The single most important factor in explaining these regional variations is the percentage of adults with bachelor's degrees.[3]

FIGURE
RF 2

Share of population 25 or older with at least a bachelor's degree
U.S. States and District of Columbia, 2006-2010



Source: American Community Survey five-year estimates (2006-2010).

Note: The size of the gray circle is proportional to the real GDP per capita in 2011

Among U.S. metropolitan areas, the disparity is just as extreme (see table RF1). The mean for the top 10 metros by average educational attainment was 14.52 years vs. 12.27 years for the bottom 10. Furthermore, real GDP per capita among the top 10 was $52,330 vs. $36,130 for the bottom 10. This variance of $16,200 was no coincidence; it is consistent with the pattern of educational attainment.

3. Ross DeVol, "The New Economics of Place," Milken Institute Review, December 2002.

TABLE

RF 1

Metros with the highest and lowest average years of schooling
Workers age 16 and older, 2010

Top 10 metros

Metro	Average years of schooling	Real GDP per capita (US$)
Fort Collins-Loveland, CO	14.78	40,369
Columbia, MO	14.66	38,433
Washington-Arlington-Alexandria, DC-VA-MD-WV	14.58	62,666
Ann Arbor, MI	14.55	48,159
San Jose-Sunnyvale-Santa Clara, CA	14.54	68,609
Boston-Cambridge-Quincy, MA-NH	14.54	58,892
Trenton-Ewing, NJ	14.45	67,133
Madison, WI	14.42	53,057
Champaign-Urbana, IL	14.38	45,445
State College, PA	14.34	40,453

Bottom 10 metros

Metro	Average years of schooling	Real GDP per capita (US$)
Visalia-Porterville, CA	11.85	29,060
Yakima, WA	11.92	30,656
Salinas, CA	11.97	36,982
Brownsville-Harlingen, TX	12.13	24,619
Merced, CA	12.18	25,334
McAllen-Edinburg-Mission, TX	12.20	21,044
Bakersfield-Delano, CA	12.33	40,494
Houma-Bayou Cane-Thibodaux, LA	12.55	50,280
Elkhart-Goshen, IN	12.67	48,212
Odessa, TX	12.67	54,634

Sources: U.S. Bureau of Economic Analysis, Moody's Analytics, American Community Survey 1-year estimates 2010, Milken Institute.

EDUCATIONAL ATTAINMENT BY OCCUPATION

Our findings show that certain industries have an outsized influence on elevating a region's educational attainment. We created a list of skilled occupations in the 50 largest metros that met the following criteria: They had a larger percentage of workers both with at least a bachelor's degree and with advanced degrees than other occupations did. We divided these occupations into five sub-categories.

The best-educated large metros generally have a high percentage of employment in three of the occupational sub-categories: executives and managers; business services; and science, engineering, and technology. In addition, these metros also tended to have better-educated workers in occupations outside these three groups.

DOES EDUCATION DRIVE ECONOMIC PROSPERITY?

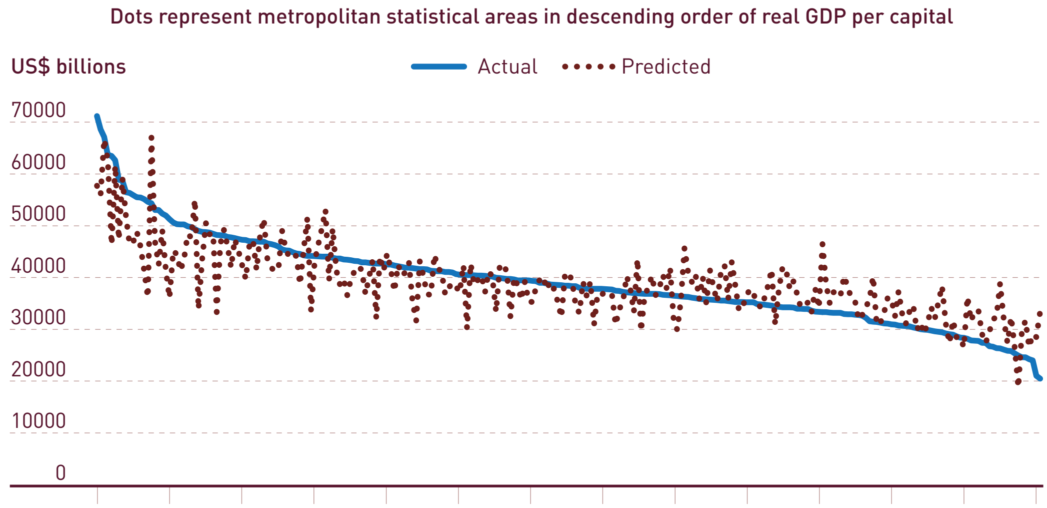
While the patterns above provide circumstantial evidence that educational attainment and regional economic prosperity are correlated, they are not a smoking gun. To measure the direct relationship between the two, we conducted a series of regression analyses based on the conceptual framework of a production function. (For details, see appendix D.)

A production function describes how factor inputs (typically including labor and physical capital) translate to production output (measured as real GDP per capita). It takes into account the age composition of the workforce, industry mix, R&D intensity as measured by patents per capita, and other structural differences. This approach assumes that each worker is embodied with different units of labor inputs, and the difference is related to his/her years of schooling. The analysis permits us to estimate the marginal rate of return of an additional year of schooling to the regional economy.

The result? The overall explanatory power of the relationship is strong and robust. Over 70 percent of the variation in real GDP per capita across the 261 metros from 1990 to 2010 is explained. Figure RF3 displays the actual vs. predicted values from the equation for 2010, providing a visual perspective of the relationship. Similar results were found for real wages per worker. All the economic factors are significant.

FIGURE
RF 3

Real GDP per capita of U.S. metros, 2010
(actual vs. predicted)



Sources: U.S. Bureau of Economic Analysis, Moody's Analytics, Milken Institute.

In the case of patents, they capture some of the explanatory effects of a high concentration of advanced degree holders in a metro economy as they are closely associated with each other. Consequently, a case can be made that the direct estimates of the returns to investment in human capital, as measured by years of schooling, are conservative.

KEY FINDINGS

Our analysis clearly demonstrates that a region's economic fortunes are closely tied to the quality of its workforce. Our major findings are:

- **Education increases regional prosperity:** Adding one extra year to the average years of schooling among the employed in a metropolitan area is associated with an increase in real GDP per capita of 10.5 percent and an increase in real wages per worker of 8.4 percent. Take Los Angeles-Long Beach-Santa Ana, CA, for example. If its employed labor force had the same average years of schooling as that of Washington-Arlington-Alexandria, DC-VA-MD-WV, its real GDP per capita in 2010 would have increased to $59,428 from $51,959. A real-life example is Danville, VA. Average years of schooling in the metro rose 1.1 years to 13.18 from 1990 to 2010. This boosted real GDP per capita by 12.2 percent or $3,440 by 2010.

- **Better educated, bigger benefits:** The benefits of additional schooling for regional economies are even greater for better-educated workers. Adding one year of schooling to the average educational attainment among employed workers with at least a high school diploma is associated with an increase in real GDP per capita of 17.4 percent and an increase in real wages per worker of 17.8 percent. In contrast, an additional year of education for workers with just nine or 10 years of schooling has little effect on real GDP per capita and real wages per worker. This finding accentuates the importance of investing in post-secondary education.

- **Certain industries lead to higher returns:** The returns to investment in education appear to be higher in some industries than in others. Given the same number of average years of schooling among the workforce, the returns to one more year of education are the greatest in metropolitan areas with a large employment share of business and IT services industries, both of which involve high-skilled jobs.

- **Clusters count:** A metro's mix of industries may be a key factor in regional differences in educational attainment within occupations. In metros with clusters of high-skilled occupations (for example, the computer software developers, engineers, and management analysts that tend to gather in a limited number of regions that have clusters of technology), the share of workers holding at least a master's degree is much higher than in metros without significant clusters. This could be because of the intense competition for employment. We also observed that in these metros skilled occupations are highly concentrated in a handful of major industries. It demonstrates that industry composition is a key factor that contributes to differences in educational attainment within occupations.

POLICY RECOMMENDATIONS

Our findings provide a compelling argument for strategic investments in higher education to enhance regional economic competitiveness and, by extension, the competitiveness of the U.S. overall. Our policy recommendations for governments, educational institutions, and businesses include:

1. Make higher education more affordable.

- **Governments: Provide financial incentives and support to individuals and institutions to increase educational choice.** Governments should further develop educational funding options and incentives such as personal income tax credits, grants, and student loans to help individuals pursue programs that best address their personal learning needs. Federal and local governments should provide adequate financial support to the public higher education system and reduce barriers to private and for-profit educational options.

- **Educational institutions: Increase efficiency to reduce costs and improve affordability.** Colleges and universities can do their part to make education more affordable by increasing operational efficiencies through technology and process improvements. Educational institutions should adopt best practices from the business community to increase cost-effectiveness and competitiveness.

- **Businesses: Offer various kinds of financial sponsorship and paid internships.** Businesses could contribute to education by providing tuition assistance, scholarships, paid internships, and other types of sponsorships to help students learn the right skills to meet market demands. Microsoft, the Coca-Cola Company, and Edison International all provide significant scholarship funds.[4] Companies such as AT&T, Walmart, Verizon, Cisco, and FedEx offer tuition assistance to encourage educational advancement.

4. Microsoft. http://careers.microsoft.com/careers/en/us/internships-scholarships.aspx#tab_urscholarship-1; Coca-Cola Company. www.coca-colacompany.com/citizenship/education.html; Edison International. https://www.scholarshipamerica.org/edisonscholars/ (accessed October 10, 2012).

2. Make higher education more accessible.

- **Governments: Remove barriers to educational choices.** Government policies should promote student choice among diverse types of institutions and programs to meet individual needs. For example, technical and professional certification programs can be effective additions or alternatives to degree programs. To increase access, governments should provide funds to support educational technologies and programs that give students more flexibility and mobility.

- **Educational institutions: Provide flexible formats conducive to adult learning.** Educational institutions should use more flexible program options and technology-enriched platforms that facilitate learning anytime, anywhere, especially for part-time students and working adults.

- **Businesses: Encourage employees to advance their education.** Businesses should support employees' professional growth by providing tuition assistance for work-related certifications and degrees. Employers can further encourage education through flexible work hours and rewards for academic progress.

3. Increase higher education graduation rates.

- **Governments: Track dropout rates effectively and minimize obstacles to completion.** Governments should develop better tracking systems to identify patterns and causes of dropouts, then act to minimize the obstacles to degree completion. Governments can promote the best practices of colleges and universities with high completion rates to establish guidelines for increasing student success.

- **Educational institutions: Offer effective counseling systems and appropriate credit transfers.** Universities and colleges should offer professional counseling and career services to better inform students about educational costs, processes, and job placement, and to help them complete the desired degree on time. Educational institutions could examine their policies on credit transfers to make sure coursework completed at other qualified institutions counts toward a degree.

- **Businesses: Create educational partnerships to demonstrate education's value.** Businesses should partner with educational institutions to provide work-study opportunities, internships, and job-entry programs to reinforce the relevance of education for career success.

4. Strengthen coordination between higher education institutions and industries.

- **Governments: Promote cooperative educational programs and develop industries that require well-educated workers.** Governments should promote work-study and internship programs in the public and private sectors, and should recognize and reward educational institutions that partner with businesses to increase educational and employment opportunities. In addition, local governments should encourage the development of industries that attract highly educated workers.

- **Educational institutions, businesses and industries: Collaborate on career pathway programs and discipline-specific sponsorships.** Collaboration between educational institutions and local industries helps develop programs and career pathways to assist students' transition into careers. Institutions should develop industry-specific certificate programs to promote skill development for specific jobs. Career services, workshops, job shadowing, and internships through business-education partnerships can increase students' workforce readiness.

5. Promote research and development.

- **Governments: Provide sufficient research and development funds.** Successful research and development (R&D) programs depend on highly educated human capital and play a critical role in accelerating economic growth. The federal government needs to provide sufficient basic R&D funding for the nation to be competitive. Making the federal R&D tax credit permanent would help provide some certainty to firms in planning their R&D investment and likely encourage more of it.[5] The federal government should also set policies that support "technology transfer"—taking innovations developed by national labs to the industries that can commercialize them.

- **Educational institutions: Collaborate with industries.** Educational institutions offer great facilities and experts for R&D, but lack the capacity to commercialize every potential innovation. Educational institutions should actively seek collaborations with industries and communities to transform research innovations into products more efficiently.[6] In addition, institutions should develop a pipeline of qualified graduates to meet the demand for future R&D opportunities in industry.

- **Businesses: Actively initiate innovative projects.** The private sector is a large funder of R&D. Businesses should continue to take the lead by actively initiating innovative projects. Also, businesses should cooperate with educational institutions so the academics' knowledge can be used to amplify economic returns and to ensure a steady pipeline of qualified graduates to meet future R&D needs.

5. Ross DeVol and Perry Wong, "Jobs for America: Investments and Policies for Economic Growth and Competitiveness," Milken Institute, 2010, pp. 24-31.
6. Ross DeVol and Armen Bedroussian, "Mind-to-Market," Milken Institute, 2006, pp. 3-24.

ON THE WEB

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INTRODUCTION

The health of a regional economy depends on many factors: human capital, innovation capacity, business investment, entrepreneurial activity, local infrastructure, tax rates and overall business climate, and regional economic development policy. While all are crucial, the skills and productivity of the workforce are arguably the most fundamental determinants of regional economic prosperity. Education—from degree programs to industry certifications and vocational training—is the key to a high-performing workforce.

How important is it? In 2011, 68 percent of 1,123 manufacturers surveyed believed that a highly skilled, flexible workforce would be most important to the success of their companies in the next three to five years. At the same time, 80 percent said the small supply of skilled production labor will be the greatest hiring challenge. In addition, 52 percent identified inadequate problem-solving skills as one of their employees' most serious deficiencies, and 43 percent also listed the lack of basic technical training.[7]

Skilled workers are not only the source of business success but also of regional economic prosperity. Pools of skilled labor attract business investment and create more demand for professional and personal services, so they stimulate local job creation and salary growth across the broader economy. As economist Enrico Moretti observed in his 2012 book, *The New Geography of Jobs*:

> "Cities with a high percentage of skilled workers offer high wages not just because they have many college-educated residents and these residents earn high wages. This would be interesting but hardly surprising. But something deeper is going on. A worker's education has an effect not just on his own salary but on the entire community around him. The presence of many college-educated residents changes the local economy in profound ways, affecting both the kinds of jobs available and the productivity of every worker who lives there, including the less skilled. This results in high wages not just for skilled workers but for most workers."

Concentrating human capital in a small geographic area helps create more rapid and higher value-added regional economic growth.[8] The single most important factor in explaining regional variations in per capita income is the percentage of adults with bachelor's degrees.[9] This supports the contention that individuals benefit from the collective spillovers that flow from others with the requisite commensurate skills. Economists would call this increasing returns to scale. In other words, as more of something is produced, the marginal benefits rise at a higher rate than the incremental inputs. It is imperative for regions and states to

7. Tom Morrison et al., "Boiling point? The skills gap in U.S. manufacturing," Deloitte and The Manufacturing Institute, 2011.
8. Paul D. Gottlieb and Michael Fogarty, "Educational Attainment and Metropolitan Growth," *Economic Development Quarterly*, 2003, 17: 325-336.
9. Ross DeVol, "The New Economics of Place," Milken Institute Review, 2001.

form or encourage pools of human capital so they can gain sustainable competitive advantages in today's globally interconnected economy. Consequently, universities, community colleges, and accredited technical and vocational training facilities are critical to regional economic growth and prosperity.

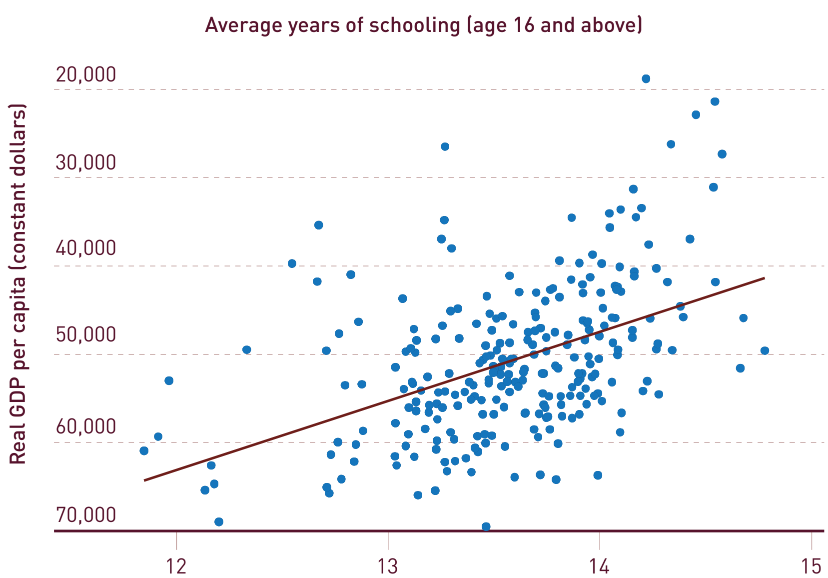
In this report, we highlight and analyze the disparities of educational attainment among the workforce in key U.S. metropolitan areas and for different occupations. We then examine the statistical relationship between the educational achievement of the workforce and regional economic prosperity, measured as real GDP per capita. The primary purpose of the study is to inform policymakers, education officials, business executives, and civic leaders about the importance of deploying deliberate strategies and investments to increase the educational attainment of human capital.

OVERVIEW OF STUDY

As a first step, we constructed a data set of educational attainment by occupation for each U.S. metropolitan area for 1990, 2000, and 2010, using the Census Bureau's Public-Use Microdata Samples (PUMS).[10] This allowed us to assess the educational attainment of each metropolitan area's workforce and compare the differences. Because different occupations require different types and levels of education, the data set also enabled us to scrutinize the educational profile of each occupation and its geographic disparities. This report focuses on selected occupations, but a supplementary webtool (www.matterofdegrees.net) provides complete educational profiles for the 50 most populous metropolitan areas and for more than 300 occupations.[11] The tool also provides information about average annual salaries and top hiring industries by occupation.

FIGURE 1-1

Educational attainment and GDP per capita
U.S. metropolitan areas, 2010



Sources: Bureau of Economic Analysis, American Community Survey one-year estimates (2010), Milken Institute.

10. The census data is downloaded from the Integrated Public Use Microdata Series (IPUMS). Steven Ruggles et al., Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]. Minneapolis: University of Minnesota, 2010.
11. See appendix B for more details about the webtool.

Figure 1-1 demonstrates the positive correlation between average years of schooling completed among the employed, based on the metro-specific data set we constructed,[12] and a region's economic output (real GDP per capita). To further isolate and identify the direct relationship between education and regional economic prosperity, we conducted a series of regression analyses based on the conceptual framework of a production function. It describes how, given the level of technological advancement and other structural factors, production inputs (typically including labor and physical capital) are transformed into final outputs (measured as real GDP per capita). We assume that each worker's productivity is positively related to the worker's years of schooling. This formulation enables us to estimate the marginal rate of return of an additional year of schooling to the regional economy.

12. See appendix A for details of data construction.

ON THE WEB

Data for each metro area can be found at ***www.matterofdegrees.net***

EDUCATIONAL ATTAINMENT BY OCCUPATION

This chapter provides an overview of workforce educational attainment in the 50 most populous metropolitan areas for 1990-2010. We analyze and compare the educational profiles for selected occupations across metropolitan areas and investigate whether the disparities, if any, may be related to the industry composition in each metropolitan area for a specific occupation.[13] For occupations not discussed in the printed report, see our supplementary webtool (www.matterofdegrees.net), where complete educational profiles can be reviewed for more than 300 occupations.

ALL OCCUPATIONS

About 90.4 percent of employed U.S. residents have at least a high school diploma, as of 2010. Nearly two-thirds have attended some college, and about half of those have at least a bachelor's degree. Degree-holders tend to work in certain metropolitan areas more than others. One reason is that some metros lack an industry mix that requires highly skilled employees, forcing better-educated individuals to seek jobs in regions with greater demand for their skills.

Table 2-1 shows the share of workers 25 or older with a bachelor's degree or higher in the 50 most populous metropolitan areas. Over the past three decades, the percentage of college graduates has soared. This is true at both the national level and in each of the 50 metros. Two of them stand out as the best-educated major metros: San Jose-Sunnyvale-Santa Clara, CA, which is the heart of the Silicon Valley, and Washington-Arlington-Alexandria, DC-VA-MD-WV, which encompasses the nation's capital. In 2010, more than half of their workforces had at least a bachelor's degree compared to the U.S. average of one-third. The two metropolitan areas are also similarly ranked when measured in the average years of schooling among those at least 16 years old: 14.54 years for the San Jose area and 14.58 years for the Washington area.

In contrast, two areas are consistently the least educated among the 50 largest metros: Las Vegas-Paradise, NV, which has predominantly a services-oriented economy, and Riverside-San Bernardino-Ontario, CA, which has one of the highest concentrations of warehouse and logistics businesses. In 2010, less than a quarter of their workforces had at least a bachelor's degree. Albeit an improvement compared to two decades ago, the number is well below the national average. The average years of schooling is 13.08 for the Las Vegas area and 12.84 years for

13. The official industry and occupation classifications have undergone significant changes over the past three decades, so we compiled the data set using the Integrated Public Use Microdata Series (IPUMS). It provides data based on the Census Bureau's PUMS files and produces consistently defined variables, allowing us to bypass the issue of changes in official classifications. Specifically, we used the OCC1990 and IND1990 variables to identify different occupations and industries, respectively. In addition, we used the PWMETRO variable to identify the metropolitan area where a worker is employed. See appendix A for details of data construction.

the Riverside metro. It is worth noting, however, that Las Vegas' share of highly educated workers has soared by 43.5 percent from 1990 to 2010—one of the biggest increases among the 50 most populous metros. But given that Las Vegas suffered the most from the Great Recession, it is unclear whether it will maintain that momentum.

In fact, the rankings of the 50 most populous metros in terms of educational attainment have been stable in the past 20 years. The 11 metros with the most-educated workforce and the 11 with the least-educated workforce have been effectively the same.

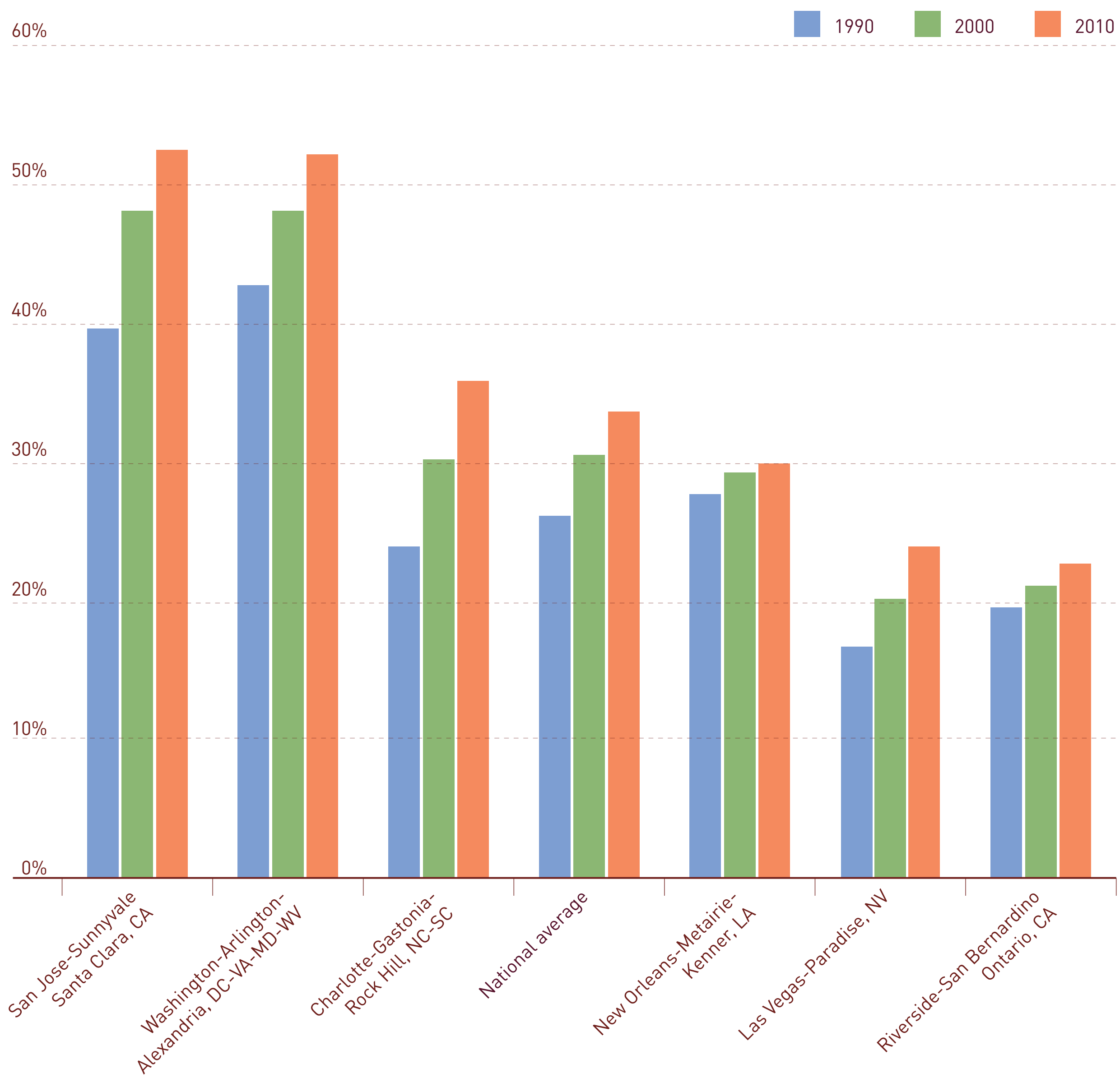
One standout is Charlotte-Gastonia-Rock Hill, NC-SC, which has made exceptional progress since 1990. The highly educated share of its workforce surged to roughly one-third in 2010 from about a quarter in 1990, pushing it to the middle of the rankings from near the bottom. This shift occurred as the metro developed into the nation's second-largest financial center (after New York). The metro has weathered the financial crisis and maintained its position as a major financial and banking hub. Its energy sector has also grown rapidly; a cluster of nearly 200 energy-related companies has created high-skilled and high-paying jobs.[14] Local colleges and universities have responded by expanding the training of energy engineers; enrollment in engineering college increased by 27 percent between 2006 and 2010.[15]

In contrast, New Orleans-Metairie-Kenner, LA, has seen only a negligible rise in the share of its workforce with at least a bachelor's degree. The stagnation was in place long before Hurricane Katrina inflicted severe social and economic damage to the region in 2005. Between 1990 and 2000, the area plummeted from the middle to the bottom ranks in educational attainment. During the same period, the number of jobs in the region grew at an annualized rate of 0.95 percent and the wage per job grew at an annualized 3.3 percent, both well below the average for all metros of 1.7 percent and 4.18 percent, respectively.[16] New Orleans' status as a major port and tourist destination has limited impact on attracting the high-caliber workforce needed for the metro to advance economically in an era dominated by information and technology industries.

14. Jim Bradley, "Energy sector continues to grow in Charlotte," WSOC-TV, May 22, 2012. www.wsoctv.com/news/news/local/energy-sector-continues-grow-charlotte/nPB4M/ (accessed August 21, 2012).
15. Paul Glader, "Charlotte looks beyond financial sector in effort to become 'energy capital,'" *Washington Post*, September 6, 2011. www.washingtonpost.com/ business/ with-electricity-firms-investment-charlotte-looks-to-become-energy-capital/2011/09/06/gIQAzBzGFK_story.html (accessed August 21, 2012).
16. U.S. Bureau of Economic Analysis.

FIGURE
2-1

Growth in educational attainment for selected metros
Share of workers 25 or older with a bachelor's or higher



TABLE

2-1

Percentage of workers 25 or older with a bachelor's degree or higher in all occupations

50 most populous metropolitan areas (2010, 2000, 1990)

Metros with highest shares of workers with a bachelor's degree or higher	2010			2000			1990		
Metropolitan area	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	52.42	± 1.14	1	48.11	± 0.73	1	39.54	± 0.97	2
Washington-Arlington-Alexandria, DC-VA-MD-WV	52.02	± 0.64	2	48.01	± 0.44	2	42.87	± 0.58	1
Boston-Cambridge-Quincy, MA-NH	49.00	± 0.75	3	44.44	± 0.49	3	39.41	± 0.66	3
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	46.54	± 0.76	4	43.71	± 0.50	4	36.93	± 0.63	4
Raleigh-Cary-Durham-Chapel Hill, NC	46.13	± 1.34	5	42.66	± 0.95	5	36.71	± 1.51	5
Austin-Round Rock-San Marcos, TX	43.28	± 1.37	6	41.49	± 0.97	6	36.06	± 1.51	6
New York-Northern New Jersey-Long Island, NY-NJ-PA	42.84	± 0.40	7	39.55	± 0.27	7	33.77	± 0.33	8
Minneapolis-St. Paul-Bloomington, MN-WI	42.14	± 0.95	8	37.73	± 0.63	10	32.34	± 0.85	11
Hartford-West Hartford-East Hartford, CT	41.61	± 1.90	9	38.16	± 1.23	8	35.09	± 1.49	7
Seattle-Tacoma-Bellevue, WA	41.11	± 0.94	10	37.95	± 0.63	9	32.36	± 0.84	10
Atlanta-Sandy Springs-Marietta, GA	40.18	± 0.81	11	37.08	± 0.55	11	32.39	± 0.81	9
Chicago-Joliet-Naperville, IL-IN-WI	40.17	± 0.59	12	36.56	± 0.39	12	30.28	± 0.50	13
Baltimore-Towson, MD	39.63	± 1.12	13	34.89	± 0.75	15	29.35	± 0.93	19
Columbus, OH	38.84	± 1.38	14	33.77	± 0.93	18	27.42	± 1.22	26
San Diego-Carlsbad-San Marcos, CA	38.84	± 1.07	14	35.03	± 0.73	13	30.07	± 0.91	14
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	38.74	± 0.77	16	34.99	± 0.51	14	29.53	± 0.63	16
Kansas City, MO-KS	38.30	± 1.30	17	33.98	± 0.87	17	28.52	± 1.13	24
Portland-Vancouver-Hillsboro, OR-WA	38.19	± 1.26	18	33.51	± 0.86	20	28.76	± 1.17	23
Richmond, VA	37.67	± 1.70	19	34.76	± 1.13	16	29.52	± 1.53	17
Pittsburgh, PA	36.39	± 1.24	20	31.57	± 0.81	27	28.78	± 1.05	22
Charlotte-Gastonia-Rock Hill, NC-SC	35.77	± 1.33	21	30.20	± 0.94	35	23.94	± 1.34	43
St. Louis, MO-IL	35.72	± 1.13	22	31.63	± 0.74	26	26.93	± 0.93	27
Sacramento-Arden-Arcade-Roseville, CA	35.43	± 1.36	23	32.87	± 0.92	22	29.63	± 1.19	15
Los Angeles-Long Beach-Santa Ana, CA	35.40	± 0.53	24	33.17	± 0.35	21	29.11	± 0.42	20
Milwaukee-Waukesha-West Allis, WI	35.40	± 1.47	24	31.79	± 0.96	24	26.36	± 1.20	30
National average	**33.66**	**± 0.11**		**30.47**	**± 0.07**		**26.17**	**± 0.09**	

Metros with highest shares of workers with a Master's degree or higher	2010			2000			1990		
Metropolitan areas	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
Birmingham-Hoover, AL	35.27	± 1.95	26	31.69	± 1.29	25	25.90	± 1.61	34
Dallas-Fort Worth-Arlington, TX	35.20	± 0.76	27	33.66	± 0.52	19	30.31	± 0.70	12
Indianapolis-Carmel, IN	35.19	± 1.38	28	30.73	± 0.93	30	25.36	± 1.26	37
Cincinnati-Middletown, OH-KY-IN	35.13	± 1.38	29	31.27	± 0.90	28	26.04	± 1.17	32
Nashville-Davidson-Murfreesboro-Franklin, TN	34.96	± 1.51	30	31.26	± 1.03	29	26.07	± 1.40	31
Buffalo-Niagara Falls, NY	34.52	± 1.82	31	30.35	± 1.15	33	25.91	± 1.39	33
Detroit-Warren-Livonia, MI	34.41	± 0.95	32	30.07	± 0.59	36	25.16	± 0.74	38
Providence-New Bedford-Fall River, RI-MA	33.74	± 1.83	33	29.41	± 1.18	39	25.67	± 1.86	35
Salt Lake City-Ogden-Clearfield, UT	33.65	± 1.55	34	30.42	± 1.08	31	28.91	± 1.70	21
Miami-Fort Lauderdale-Pompano Beach, FL	33.43	± 1.12	35	29.59	± 0.77	38	24.30	± 0.74	42
Oklahoma City, OK	33.24	± 1.86	36	30.25	± 1.25	34	26.72	± 1.52	28
Cleveland-Elyria-Mentor, OH	32.71	± 1.29	37	29.79	± 0.80	37	25.66	± 1.02	36
Phoenix-Mesa-Glendale, AZ	32.66	± 1.01	38	30.38	± 0.71	32	26.54	± 1.02	29
Houston-Sugar Land-Baytown, TX	32.63	± 0.81	39	32.23	± 0.57	23	29.37	± 0.74	18
Orlando-Kissimmee-Sanford, FL	31.74	± 1.31	40	28.61	± 0.94	42	25.00	± 1.34	40
Memphis, TN-MS-AR	31.51	± 1.83	41	28.99	± 1.20	41	24.76	± 1.56	41
Tampa-St. Petersburg-Clearwater, FL	31.49	± 1.20	42	27.18	± 0.83	45	23.10	± 1.07	45
Louisville-Jefferson County, KY-IN	31.29	± 1.86	43	26.61	± 1.23	46	22.70	± 1.58	47
Virginia Beach-Norfolk-Newport News, VA	30.53	± 1.51	44	27.64	± 1.00	43	23.46	± 1.33	44
Greensboro-Winston-Salem-High Point, NC	30.17	± 1.67	45	26.02	± 1.09	48	22.96	± 1.49	46
New Orleans-Metairie-Kenner, LA	29.89	± 1.98	46	29.28	± 1.16	40	27.63	± 1.49	25
San Antonio-New Braunfels, TX	29.77	± 1.47	47	27.50	± 1.03	44	25.10	± 1.39	39
Jacksonville, FL	29.58	± 1.72	48	26.34	± 1.19	47	22.66	± 1.70	48
Las Vegas-Paradise, NV	24.04	± 1.48	49	20.21	± 1.12	50	16.75	± 1.74	50
Riverside-San Bernardino-Ontario, CA	22.64	± 1.21	50	20.97	± 0.88	49	19.43	± 1.12	49
National average	**33.66**	**± 0.11**		**30.47**	**± 0.07**		**26.17**	**± 0.09**	

Notes
(1) Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
(2) The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in the estimated share of workers may not be statistically significant.

COMPUTER SOFTWARE DEVELOPERS

NATIONAL OUTLOOK		
Typical education needed for entry:	Projected employment growth, 2010-2020:	2010 median annual pay:
Bachelor's degree	**30%**	**$90,530**

(Source: Bureau of Labor Statistics)

Computer software developer is one of the highest-paid and most in-demand occupations in the U.S. The educational attainment of software developers, compared to that of an average worker, is much higher and has increased at a faster rate, especially from 1990 to 2000 (see table 2-2). In 2010, around 78 percent of computer software engineers held at least a bachelor's degree, an increase of 20 percentage points since 1990. Three-quarters of this increase can be attributed to the growing number of software developers with at least a master's degree. While a bachelor's degree is the typical education needed to become a computer software developer, an increasing number of them have opted to pursue an advanced degree to gain a competitive edge.

This is particularly true in metropolitan areas with high concentrations of software developers (measured by location quotient, or LQ[17]). In the San Jose metro, where the share of software developers is almost eight times the national average, half of them had at least a master's degree in 2010, double the share in 1990.[18] In fact, a software developer without at least a bachelor's degree is a rarity in the Silicon Valley; more than 90 percent held them in 2010. In comparison, about 70 percent of software developers in Salt Lake City-Ogden-Clearfield, UT, have a bachelor's degree or higher.

Industry composition plays an important role in the differences in educational attainment across metros. Nationwide, the industries that hire computer software developers are predominantly 1) computer and data processing services and 2) durable goods manufacturers, which accounted for 35 percent and 14 percent of employment, respectively, in 2010. However, while three-quarters of software developers in the San Jose area are employed in these two industries, those industries employ less than half the developers in the Salt Lake City metro. It is plausible that the average level of educational attainment is lower among software developers employed in other industries, such as religious organizations, insurance companies, etc.

17. Location quotient (LQ) measures the concentration of occupational employment in a metro using the nation as a benchmark. For any occupation, an LQ greater than 1 indicates that a metro's employment share in this occupation is higher than the corresponding share in the nation; conversely, an LQ less than 1 indicates a lower share than the national average.
18. For a more thorough understanding of this phenomenon, see Ross DeVol, Kevin Klowden, Armen Bedroussian, and Benjamin Yeo, "North America's High-Tech Economy: The Geography of Knowledge-Based Industries," Milken Institute, 2009.

FIGURE
2-2

Share of degree-holding software developers 25 or older (2010)

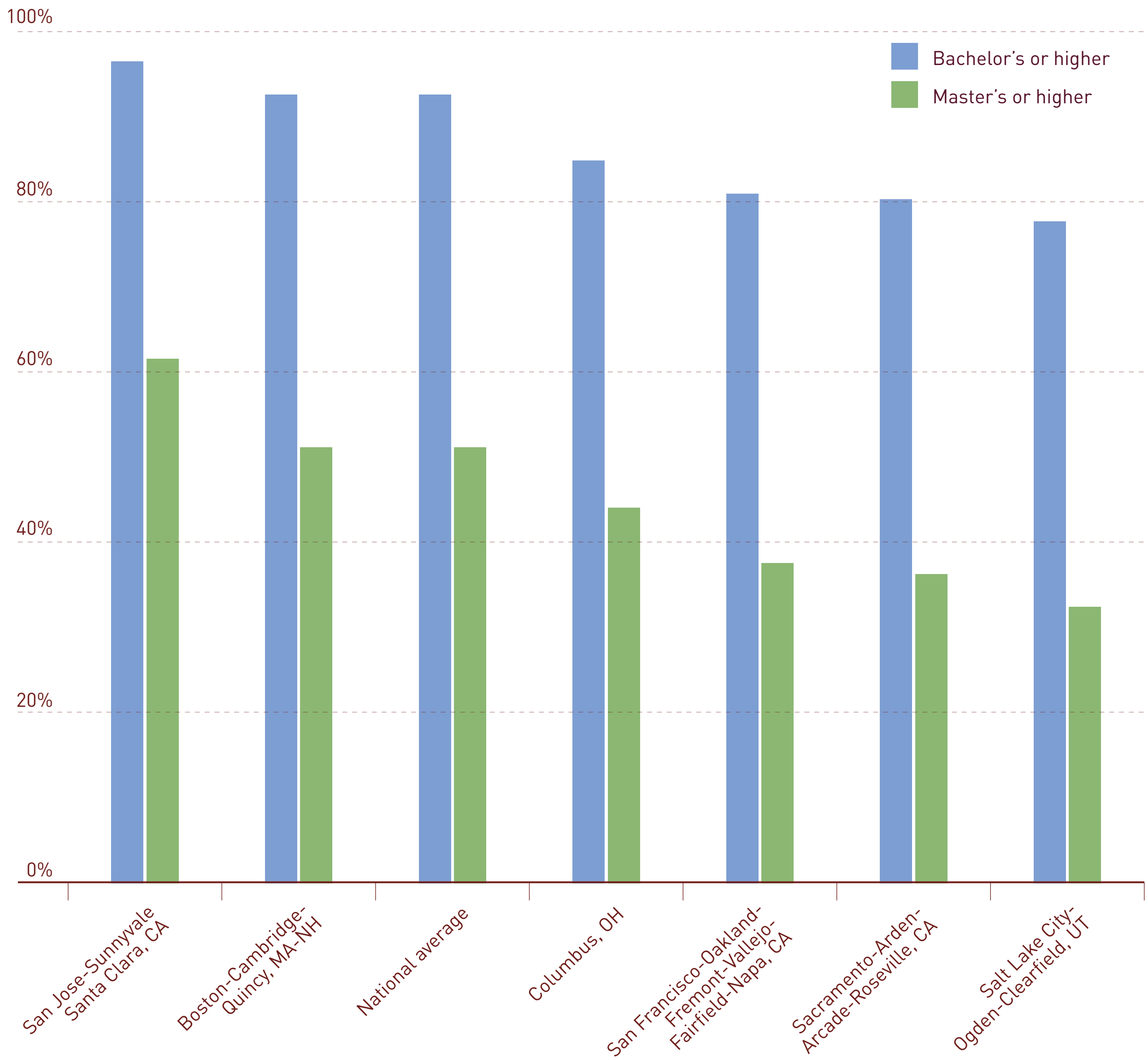


TABLE
2-2

Share of degree-holding software developers 25 or older
25 large metropolitan areas with a higher concentration of software developers (2010, 2000, 1990)

Bachelor's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	7.92	92.69	± 1.75	1	87.98	± 1.44	1	71.00	± 4.92	2
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	2.61	87.88	± 2.44	2	81.77	± 1.84	2	69.86	± 4.60	3
Boston-Cambridge-Quincy, MA-NH	2.69	87.62	± 2.44	3	80.75	± 1.82	3	67.99	± 4.74	5
New York-Northern New Jersey-Long Island, NY-NJ-PA	1.37	84.60	± 1.91	4	78.31	± 1.33	6	65.35	± 2.69	7
Chicago-Joliet-Naperville, IL-IN-WI	1.26	83.65	± 2.95	5	76.84	± 2.01	8	60.28	± 4.52	13
Raleigh-Cary-Durham-Chapel Hill, NC	2.72	82.88	± 4.90	6	78.60	± 3.27	5	67.67	± 8.11	6
Austin-Round Rock-San Marcos, TX	2.91	82.53	± 4.73	7	80.40	± 3.31	4	75.41	± 7.29	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	3.23	82.24	± 2.42	8	76.67	± 1.70	9	64.73	± 3.80	9
San Diego-Carlsbad-San Marcos, CA	1.97	82.18	± 4.47	9	76.10	± 3.52	10	68.89	± 7.57	4
Seattle-Tacoma-Bellevue, WA	3.62	80.54	± 3.12	10	77.39	± 2.57	7	58.60	± 7.64	15
Orlando-Kissimmee-Sanford, FL	1.28	79.72	± 6.78	11	66.66	± 6.09	20	53.85	± 13.79	22
Baltimore-Towson, MD	1.89	79.52	± 5.07	12	70.99	± 4.14	16	55.76	± 8.49	19
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.43	79.41	± 3.97	13	73.22	± 2.79	13	58.81	± 5.47	14
Dallas-Fort Worth-Arlington, TX	1.84	79.28	± 3.37	14	73.69	± 2.35	12	64.87	± 4.88	8
Atlanta-Sandy Springs-Marietta, GA	1.76	78.76	± 3.93	15	72.41	± 2.80	14	63.32	± 6.25	10
St. Louis, MO-IL	1.35	78.12	± 5.98	16	73.97	± 4.08	11	62.53	± 7.83	11
Minneapolis-St. Paul-Bloomington, MN-WI	2.05	77.10	± 4.47	17	71.07	± 3.18	15	61.15	± 6.25	12
Milwaukee-Waukesha-West Allis, WI	1.27	76.13	± 8.51	18	66.40	± 6.60	22	46.73	± 14.93	24
Kansas City, MO-KS	1.68	75.85	± 6.72	19	65.09	± 4.92	23	54.73	± 10.01	20
Portland-Vancouver-Hillsboro, OR-WA	1.75	75.36	± 6.41	20	67.63	± 4.91	19	58.41	± 12.68	16
Phoenix-Mesa-Glendale, AZ	1.31	74.24	± 5.78	21	66.48	± 4.15	21	46.61	± 10.57	25
Columbus, OH	1.80	73.44	± 7.17	22	70.44	± 4.76	17	49.88	± 10.84	23
Hartford-West Hartford-East Hartford, CT	1.97	73.09	± 9.84	23	68.20	± 6.28	18	54.60	± 10.69	21
Sacramento-Arden-Arcade-Roseville, CA	1.50	72.74	± 7.59	24	59.83	± 5.99	25	56.60	±11.28	17
Salt Lake City-Ogden-Clearfield, UT	1.57	69.56	± 8.78	25	63.90	± 6.55	24	56.15	± 14.59	18
National average		**78.34**	**± 0.62**		**71.87**	**± 0.44**		**58.95**	**± 0.91**	

Master's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	7.92	50.40	± 4.56	1	42.96	± 3.14	1	23.71	± 7.98	1
Boston-Cambridge-Quincy, MA-NH	2.69	37.80	± 5.46	2	33.34	± 3.38	3	19.84	± 7.50	4
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	2.61	37.78	± 5.53	3	32.53	± 3.53	4	20.82	± 7.46	2
Washington-Arlington-Alexandria, DC-VA-MD-WV	3.23	37.23	± 4.56	4	31.86	± 2.91	5	14.37	± 5.93	8
New York-Northern New Jersey-Long Island, NY-NJ-PA	1.37	37.09	± 3.86	5	33.78	± 2.32	2	20.69	± 4.08	3
Baltimore-Towson, MD	1.89	35.13	± 9.02	6	23.73	± 6.71	12	13.07	± 11.90	13
Chicago-Joliet-Naperville, IL-IN-WI	1.26	33.61	± 5.95	7	26.39	± 3.58	8	13.35	± 6.68	12
San Diego-Carlsbad-San Marcos, CA	1.97	31.24	± 8.78	8	24.35	± 6.26	11	17.98	± 12.30	5
Seattle-Tacoma-Bellevue, WA	3.62	30.35	± 5.91	9	25.41	± 4.67	9	13.37	± 11.05	11
Raleigh-Cary-Durham-Chapel Hill, NC	2.72	30.15	± 9.90	10	28.57	± 5.97	6	15.03	± 13.15	7
Dallas-Fort Worth-Arlington, TX	1.84	29.39	± 6.21	11	24.63	± 3.98	10	12.49	± 7.71	16
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.43	28.00	± 7.42	12	23.45	± 4.72	13	13.04	± 7.95	14
Austin-Round Rock-San Marcos, TX	2.91	27.33	± 9.65	13	27.50	± 6.37	7	17.47	± 13.36	6
Atlanta-Sandy Springs-Marietta, GA	1.76	27.13	± 7.29	14	22.57	± 4.69	15	12.22	± 9.66	17
Portland-Vancouver-Hillsboro, OR-WA	1.75	25.97	± 11.11	15	22.40	± 7.61	16	7.02	± 18.96	24
St. Louis, MO-IL	1.35	25.83	± 11.01	16	22.84	± 7.03	14	9.91	± 12.14	19
Orlando-Kissimmee-Sanford, FL	1.28	25.78	± 12.97	17	20.36	± 9.41	18	6.09	± 19.68	25
Hartford-West Hartford-East Hartford, CT	1.97	25.59	± 16.37	18	17.49	± 10.11	20	12.65	± 14.83	15
Phoenix-Mesa-Glendale, AZ	1.31	24.05	± 9.93	19	19.63	± 6.42	19	9.04	± 13.79	21
Milwaukee-Waukesha-West Allis, WI	1.27	22.09	± 15.37	20	14.96	± 10.50	24	13.92	± 18.98	9
Minneapolis-St. Paul-Bloomington, MN-WI	2.05	21.80	± 8.26	21	14.99	± 5.44	23	9.65	± 9.53	20
Kansas City, MO-KS	1.68	21.39	± 12.12	22	15.91	± 7.64	22	8.14	± 14.26	23
Columbus, OH	1.80	20.79	± 12.39	23	20.50	± 7.80	17	12.01	± 14.37	18
Sacramento-Arden-Arcade-Roseville, CA	1.50	19.07	± 13.08	24	16.72	± 8.63	21	13.86	± 15.89	10
Salt Lake City-Ogden-Clearfield, UT	1.57	14.79	± 14.68	25	13.53	± 10.14	25	8.81	± 21.04	22
National average		**28.45**	**± 1.13**		**24.04**	**± 0.73**		**13.30**	**± 1.32**	

Notes:
1. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
2. The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.
3. LQ stands for "location quotient," which measures the concentration of occupational employment in a metro using the nation as a benchmark.

ENGINEERS

NATIONAL OUTLOOK		
Typical education needed for entry:	Projected employment growth, 2010-2020:	2010 median annual pay:
Bachelor's degree	**10.6%**	**$83,340**

(Source: Bureau of Labor Statistics)

Engineering is a highly remunerated occupation. However, future employment growth will likely be slower than the average because certain fields of engineering are less in demand now that physical manufacturing activities are largely outsourced.[19]

The average educational attainment of engineers has been among the highest of all occupations for the past two decades. In 1990, the percentage of employed engineers with at least a bachelor's degree was already as high as 70 percent nationwide, and the fraction holding at least a master's degree was slightly more than one-fifth (see table 2-3).

Over the past 20 years, the gain in educational attainment is mostly due to the increase in advanced degrees. The improvement is especially pronounced in a handful of metropolitan areas, with the San Jose area hosting the most-educated engineers (90 percent with at least a bachelor's degree and 51 percent with at least a master's degree, as of 2010). However, educational attainment of engineers seems to have stagnated in a few other metros, such as Cleveland-Elyria-Mentor, OH, where more than 95,000 manufacturing jobs vanished between 1990 and 2010.[20]

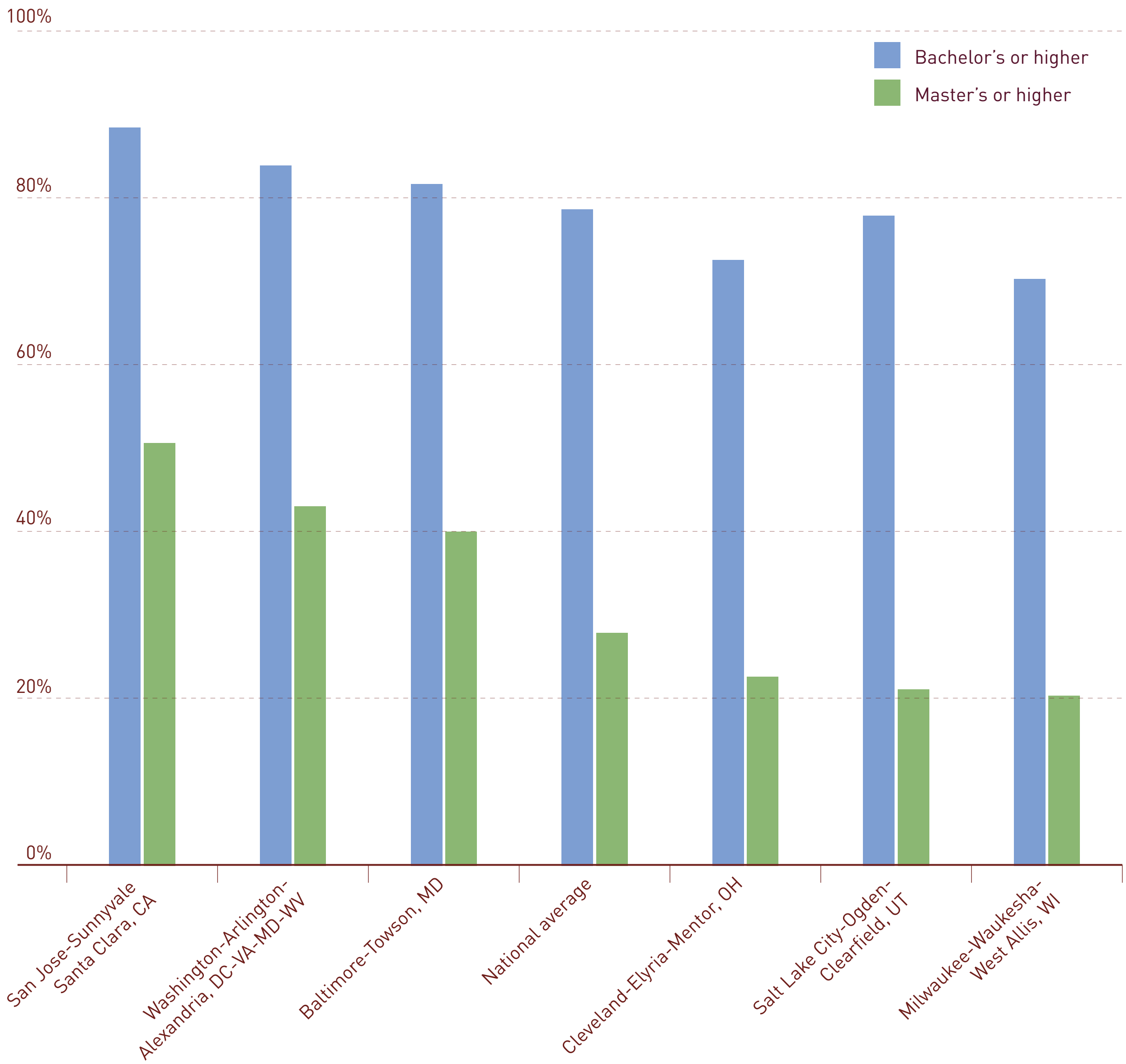
Although the Silicon Valley attracts the best-educated engineers and software engineers, it would be wrong to presume that the geographical distributions of these two occupations are similar. For example, some metros with significant clusters of engineers, such as Detroit-Warren-Livonia, MI and Houston-Sugar Land-Baytown, TX, do not have comparable clusters of software developers.

Nationwide, the top hiring industries for engineers are 1) durable goods manufacturing and 2) engineering, architectural, and surveying services. These accounted for about 40 percent and 21 percent of employment in 2010, respectively. In the San Jose metro, however, more than two-thirds of engineers are employed in durable goods manufacturing, and less than a tenth work in engineering, architectural, and surveying services. In comparison, 66 percent of engineers in the Cleveland metro are hired by the two industries, while others are employed in industries such as nondurable goods manufacturing, public administration, and utilities and sanitation services.

19. Mark Mather and Diana Lavery, "U.S. Science and Engineering Labor Force Stalls, but Trends Vary Across States." Population Reference Bureau, 2012. www.prb.org/Articles/2012/scientists-engineers.aspx?p=1 (accessed October 24, 2012).
20. U.S. Bureau of Labor Statistics.

FIGURE
2-3

Share of degree-holding engineers 25 or older (2010)



TABLE

2-3

Share of degree-holding engineers 25 or older

25 large metropolitan areas with a higher concentration of software developers (2010, 2000, 1990)

Bachelor's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	5.17	89.54	± 2.15	1	83.46	± 1.66	1	78.31	± 2.31	6
Houston-Sugar Land-Baytown, TX	1.93	85.45	± 2.49	2	81.59	± 1.93	2	81.38	± 2.31	1
Austin-Round Rock-San Marcos, TX	2.03	85.20	± 4.47	3	78.36	± 3.49	6	79.28	± 5.56	2
Washington-Arlington-Alexandria, DC-VA-MD-WV	1.60	84.85	± 2.60	4	79.85	± 2.04	3	78.71	± 2.30	4
Pittsburgh, PA	1.32	83.90	± 5.01	5	79.26	± 3.59	4	75.93	± 4.50	9
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.39	83.43	± 3.29	6	78.38	± 2.35	5	75.53	± 2.82	10
Raleigh-Cary-Durham-Chapel Hill, NC	1.65	82.94	± 5.32	7	75.09	± 4.25	18	67.91	± 6.41	20
Los Angeles-Long Beach-Santa Ana, CA	1.27	82.90	± 2.18	8	77.67	± 1.55	9	72.46	± 1.66	14
Sacramento-Arden-Arcade-Roseville, CA	1.33	82.77	± 5.45	9	78.29	± 3.85	7	77.65	± 4.96	7
Seattle-Tacoma-Bellevue, WA	2.14	82.47	± 3.21	10	76.26	± 2.60	13	79.09	± 2.73	3
Baltimore-Towson, MD	1.46	82.38	± 4.56	11	76.08	± 3.44	14	77.33	± 3.56	8
San Diego-Carlsbad-San Marcos, CA	1.96	81.55	± 3.88	12	75.17	± 3.04	17	71.80	± 3.97	16
Boston-Cambridge-Quincy, MA-NH	1.72	81.41	± 3.12	13	76.64	± 2.10	11	73.56	± 2.59	11
Phoenix-Mesa-Glendale, AZ	1.42	81.36	± 4.02	14	76.42	± 2.89	12	72.28	± 4.05	15
Minneapolis-St. Paul-Bloomington, MN-WI	1.43	81.22	± 4.09	15	72.94	± 3.21	20	69.86	± 4.00	18
Dallas-Fort Worth-Arlington, TX	1.29	80.34	± 3.31	16	72.94	± 2.38	20	72.61	± 2.79	13
Detroit-Warren-Livonia, MI	2.85	80.32	± 2.81	17	76.06	± 1.81	15	66.67	± 2.99	22
Cincinnati-Middletown, OH-KY-IN	1.30	79.92	± 6.12	18	70.95	± 4.23	22	64.79	± 5.58	24
Portland-Vancouver-Hillsboro, OR-WA	1.81	79.70	± 4.86	19	78.08	± 3.45	8	66.45	± 5.98	23
Salt Lake City-Ogden-Clearfield, UT	1.38	78.56	± 6.60	20	75.52	± 4.85	16	70.63	± 7.15	17
Hartford-West Hartford-East Hartford, CT	1.67	78.51	± 8.19	21	74.67	± 5.57	19	73.09	± 6.23	12
New Orleans-Metairie-Kenner, LA	1.36	76.89	± 8.90	22	77.13	±5.08	10	78.40	± 6.20	5
Cleveland-Elyria-Mentor, OH	1.21	73.18	± 6.78	23	69.55	± 4.21	23	69.66	± 5.13	19
Virginia Beach-Norfolk-Newport News, VA-NC	1.60	72.92	± 6.95	24	69.20	± 4.99	24	67.75	± 5.79	21
Milwaukee-Waukesha-West Allis, WI	1.50	71.00	± 7.29	25	67.01	± 4.90	25	63.47	± 6.59	25
National average		**79.34**	**± 0.53**		**74.14**	**± 0.37**		**70.51**	**± 0.46**	

Master's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	5.17	50.93	± 4.65	1	41.13	± 3.13	1	33.24	± 4.05	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	1.60	43.22	± 5.04	2	36.56	± 3.63	2	32.26	± 4.10	2
Baltimore-Towson, MD	1.46	40.68	± 8.36	3	34.86	± 5.68	3	24.97	± 6.47	7
Hartford-West Hartford-East Hartford, CT	1.67	38.49	± 13.85	4	32.84	± 9.06	4	24.01	± 10.47	9
Boston-Cambridge-Quincy, MA-NH	1.72	36.02	± 5.79	5	29.85	± 3.64	7	28.56	± 4.26	3
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.39	35.75	± 6.49	6	30.98	± 4.21	6	26.87	± 4.87	5
Austin-Round Rock-San Marcos, TX	2.03	35.10	± 9.36	7	28.73	± 6.33	9	26.92	± 10.45	4
Detroit-Warren-Livonia, MI	2.85	34.54	± 5.12	8	29.62	± 3.10	8	19.16	±4.66	16
Los Angeles-Long Beach-Santa Ana, CA	1.27	32.78	± 4.32	9	31.03	± 2.72	5	25.25	± 2.74	6
Sacramento-Arden-Arcade-Roseville, CA	1.33	32.78	± 10.76	9	23.99	± 7.20	16	16.66	± 9.58	23
Phoenix-Mesa-Glendale, AZ	1.42	31.32	± 7.72	11	25.62	± 5.13	12	16.77	± 7.01	22
Portland-Vancouver-Hillsboro, OR-WA	1.81	31.26	± 8.94	12	27.31	± 6.29	10	18.02	± 9.35	19
Raleigh-Cary-Durham-Chapel Hill, NC	1.65	30.99	± 10.70	13	23.86	± 7.43	17	17.85	± 10.26	21
San Diego-Carlsbad-San Marcos, CA	1.96	30.62	± 7.52	14	25.89	± 5.26	11	20.20	± 6.68	14
Houston-Sugar Land-Baytown, TX	1.93	30.11	± 5.45	15	25.62	± 3.88	12	24.65	± 4.64	8
Dallas-Fort Worth-Arlington, TX	1.29	29.67	± 6.26	16	25.35	± 3.95	14	19.55	± 4.77	15
Seattle-Tacoma-Bellevue, WA	2.14	27.79	± 6.52	17	22.92	± 4.68	18	18.70	± 5.39	17
Cincinnati-Middletown, OH-KY-IN	1.30	27.07	± 11.66	18	22.90	± 6.89	19	20.50	± 8.39	13
Pittsburgh, PA	1.32	26.75	± 10.69	19	24.01	± 6.87	15	23.46	± 8.02	11
Virginia Beach-Norfolk-Newport News, VA-NC	1.60	24.57	± 11.59	20	22.89	± 7.90	20	16.51	± 9.32	24
New Orleans-Metairie-Kenner, LA	1.36	23.33	± 16.21	21	21.47	± 9.40	21	18.28	± 12.05	18
Minneapolis-St. Paul-Bloomington, MN-WI	1.43	22.95	± 8.29	22	19.18	± 5.55	23	13.86	± 6.75	25
Cleveland-Elyria-Mentor, OH	1.21	22.63	± 11.52	23	19.67	± 6.84	22	22.33	± 8.20	12
Salt Lake City-Ogden-Clearfield, UT	1.38	21.56	± 12.61	24	19.04	± 8.82	24	23.71	± 11.53	10
Milwaukee-Waukesha-West Allis, WI	1.50	20.83	± 12.05	25	17.44	± 7.75	25	17.99	± 9.88	20
National average		**28.32**	**± 0.98**		**24.56**	**± 0.64**		**20.98**	**± 0.76**	

Notes:
4. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
5. The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.
6. LQ stands for "location quotient," which measures the concentration of occupational employment in a metro using the nation as a benchmark

MANAGEMENT ANALYSTS

NATIONAL OUTLOOK		
Typical education needed for entry:	Projected employment growth, 2010-2020:	2010 median annual pay:
Bachelor's degree	**21.9%**	**$78,160**

(Source: Bureau of Labor Statistics)

Management analyst has always been a highly educated occupation. In 2010, about 77 percent of them held at least a bachelor's degree, and about 36 percent held an advanced degree (see table 2-4). The majority—58 percent—are employed in the management and public relations service industry, and about 23 percent are self-employed consultants.[21]

Among the 50 most populous metros, the Washington area has the highest concentration of management analysts. Their presence in the regional workforce is 3.7 times higher than the national average. Almost 90 percent hold at least a bachelor's degree, and, remarkably, half hold at least a master's degree. Similar levels of educational attainment among management analysts can be found in the San Jose, San Francisco, and Boston metros, all of which have significant clusters of these professionals. Minneapolis-St. Paul-Bloomington, MN-WI stands in contrast. Although the metro has the second-highest concentration of management analysts, educational attainment is much lower than in the metros mentioned above, and the disparity is more or less consistent over time, especially when measured by the share of those with advanced degrees.

Further investigation into the top hiring industries in each metro may help explain the differences. For example, two-thirds of management analysts in the Washington and San Francisco metros work in the management and public relations service industry. In comparison, management analysts in the Minneapolis area are spread out more across different industries: Just 47 percent of them work in the management and public relations service industry, and the others are employed in a wide variety of industries including finance, manufacturing, and wholesale sectors. It is possible that competition in the business services sector, which includes management and public relations services, is more acute, so an advanced degree is imperative for career progression.

21. U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, www.bls.gov/ooh/business-and-financial/management-analysts.htm#tab-3 (accessed August 24, 2012).

FIGURE
2-4

Share of degree-holding management analysts 25 or older (2010)

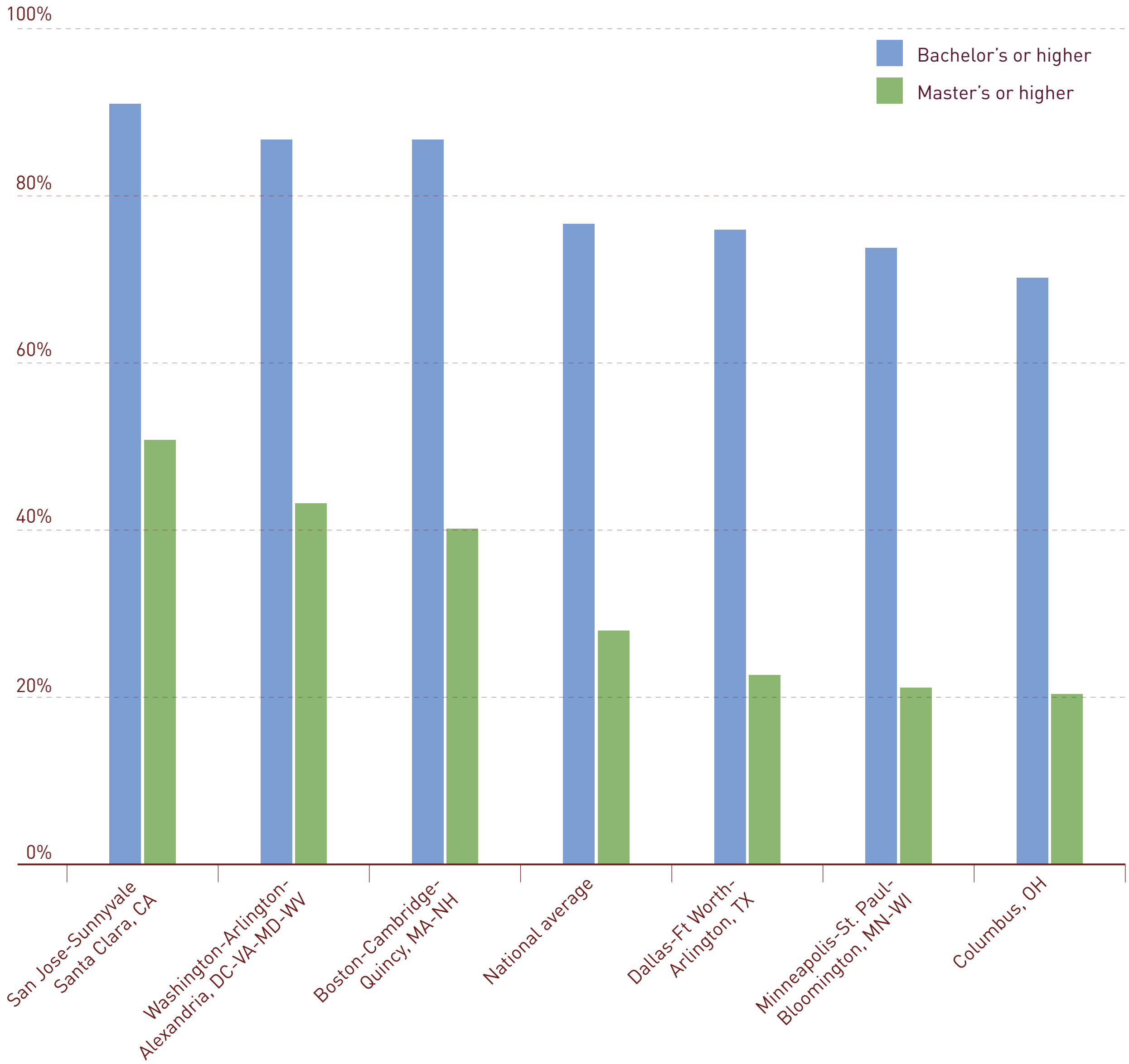


TABLE
2-4

Share of degree-holding management analysts 25 or older
25 large metropolitan areas with a higher concentration of management analysts (2010, 2000, 1990)

Bachelor's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank	Share of workers with B.A. or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	1.58	91.02	± 5.77	1	79.24	± 5.28	7	75.52	± 9.79	8
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.86	86.92	± 3.99	2	85.17	± 2.61	2	76.36	± 5.36	6
Washington-Arlington-Alexandria, DC-VA-MD-WV	3.70	86.78	± 2.54	3	81.54	± 2.17	5	75.93	± 3.83	7
Boston-Cambridge-Quincy, MA-NH	2.06	86.62	± 3.86	4	89.18	± 2.25	1	83.28	± 4.40	1
Chicago-Joliet-Naperville, IL-IN-WI	1.70	85.43	± 3.26	5	82.07	± 2.38	3	77.08	± 4.62	5
New York-Northern New Jersey-Long Island, NY-NJ-PA	1.32	85.27	± 2.60	6	81.33	± 1.91	6	78.66	± 3.09	2
Raleigh-Cary-Durham-Chapel Hill, NC	1.52	83.05	± 8.69	7	76.78	± 7.36	9	69.31	± 16.87	14
Atlanta-Sandy Springs-Marietta, GA	1.97	80.51	± 4.76	8	81.67	± 3.22	4	77.49	± 7.45	4
Charlotte-Gastonia-Rock Hill, NC-SC	1.23	80.28	± 9.54	9	70.86	± 8.09	18	75.35	± 14.98	9
Seattle-Tacoma-Bellevue, WA	1.48	78.68	± 6.69	10	76.22	± 4.71	10	71.43	± 8.98	12
Houston-Sugar Land-Baytown, TX	1.27	78.33	± 5.88	11	75.67	± 4.42	11	64.90	± 10.66	19
San Diego-Carlsbad-San Marcos, CA	1.48	78.23	± 7.53	12	68.48	± 6.77	21	61.41	± 11.65	22
Richmond, VA	1.81	78.13	± 10.85	13	72.96	± 9.59	16	73.01	± 16.70	11
Austin-Round Rock-San Marcos, TX	1.68	77.88	± 9.27	14	73.30	± 8.37	14	60.20	± 18.83	24
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.32	77.72	± 5.79	15	78.71	± 3.82	8	67.91	± 6.75	16
Sacramento-Arden-Arcade-Roseville, CA	1.18	77.24	± 10.61	16	63.40	± 9.04	25	62.18	± 12.46	21
Baltimore-Towson, MD	1.43	76.98	± 8.23	17	70.42	± 6.57	19	64.22	± 11.10	20
Kansas City, MO-KS	1.14	76.41	± 10.93	18	73.42	± 7.53	13	66.70	± 14.82	18
Dallas-Fort Worth-Arlington, TX	1.42	75.63	± 5.62	19	73.13	± 3.89	15	67.06	± 8.32	17
Minneapolis-St. Paul-Bloomington, MN-WI	2.16	73.94	± 6.28	20	72.83	± 4.70	17	75.32	± 7.42	10
Portland-Vancouver-Hillsboro, OR-WA	1.34	73.46	± 10.27	21	65.85	± 8.78	22	71.19	± 12.92	13
Pittsburgh, PA	1.19	73.01	± 10.65	22	74.74	± 7.72	12	77.82	± 11.67	3
Phoenix-Mesa-Glendale, AZ	1.24	72.66	± 8.22	23	68.97	± 6.32	20	61.21	± 11.93	23
Columbus, OH	1.51	70.00	± 11.09	24	64.35	± 7.89	23	69.09	± 12.91	15
Hartford-West Hartford-East Hartford, CT	1.76	66.96	± 15.43	25	63.84	± 9.81	24	58.45	± 18.75	25
National average		**76.78**	**± 0.91**		**73.95**	**± 0.66**		**68.27**	**± 1.18**	

Master's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
San Jose-Sunnyvale-Santa Clara, CA	1.58	52.68	± 13.25	1	39.15	± 9.05	6	36.51	± 15.77	6
Washington-Arlington-Alexandria, DC-VA-MD-WV	3.70	49.58	± 4.97	2	44.98	± 3.74	3	42.49	± 5.91	2
Boston-Cambridge-Quincy, MA-NH	2.06	49.52	± 7.50	3	52.09	± 4.73	1	47.96	± 7.77	1
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.86	46.20	± 8.10	4	45.89	± 4.99	2	41.59	± 8.43	3
Raleigh-Cary-Durham-Chapel Hill, NC	1.52	43.66	± 15.84	5	34.55	± 12.36	12	35.26	± 24.50	7
Chicago-Joliet-Naperville, IL-IN-WI	1.70	43.21	± 6.43	6	38.89	± 4.40	7	39.17	± 7.53	4
New York-Northern New Jersey-Long Island, NY-NJ-PA	1.32	41.24	± 5.19	7	42.11	± 3.37	4	38.10	± 5.26	5
San Diego-Carlsbad-San Marcos, CA	1.48	36.70	± 12.84	8	31.47	± 9.98	14	25.25	± 16.21	19
Baltimore-Towson, MD	1.43	36.28	± 13.69	9	35.01	± 9.74	11	26.96	± 15.87	17
Richmond, VA	1.81	35.97	± 18.57	10	29.82	± 15.46	19	31.90	± 26.53	13
Seattle-Tacoma-Bellevue, WA	1.48	35.88	± 11.60	11	35.08	± 7.78	10	34.74	± 13.57	8
Pittsburgh, PA	1.19	35.19	± 16.51	12	35.33	± 12.35	8	28.38	± 20.96	16
Atlanta-Sandy Springs-Marietta, GA	1.97	33.99	± 8.77	13	41.59	± 5.74	5	26.21	± 13.48	18
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	1.32	33.79	± 9.98	14	35.25	± 6.66	9	33.05	± 9.75	11
Houston-Sugar Land-Baytown, TX	1.27	33.59	± 10.29	15	30.84	± 7.45	16	31.62	± 14.89	14
Portland-Vancouver-Hillsboro, OR-WA	1.34	33.36	± 16.28	16	24.18	± 13.08	24	32.67	± 19.75	12
Austin-Round Rock-San Marcos, TX	1.68	33.22	± 16.11	17	31.28	± 13.42	15	33.26	± 24.38	9
Charlotte-Gastonia-Rock Hill, NC-SC	1.23	31.98	± 17.72	18	30.07	± 12.53	18	22.13	± 26.63	24
Kansas City, MO-KS	1.14	30.56	± 18.75	19	30.54	± 12.18	17	33.12	± 21.00	10
Hartford-West Hartford-East Hartford, CT	1.76	29.83	± 22.48	20	21.62	± 14.44	25	14.05	± 26.97	25
Phoenix-Mesa-Glendale, AZ	1.24	29.82	± 13.18	21	28.78	± 9.57	21	24.90	± 16.60	20
Sacramento-Arden-Arcade-Roseville, CA	1.18	29.17	± 18.72	22	29.09	± 12.59	20	24.82	± 17.57	21
Dallas-Fort Worth-Arlington, TX	1.42	28.34	± 9.64	23	33.00	± 6.14	13	28.87	± 12.22	15
Minneapolis-St. Paul-Bloomington, MN-WI	2.16	27.56	± 10.47	24	25.13	± 7.81	22	22.17	± 13.18	23
Columbus, OH	1.51	24.92	± 17.54	25	24.45	± 11.49	23	23.78	± 20.28	22
National average		**35.66**	**± 1.52**		**34.58**	**± 1.05**		**31.82**	**± 1.72**	

Notes:
1. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
2. The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.
3. LQ stands for "location quotient," which measures the concentration of occupational employment in a metro using the nation as a benchmark.

REGISTERED NURSES

NATIONAL OUTLOOK		
Typical education needed for entry:	**Projected employment growth, 2010-2020:**	**2010 median annual pay:**
Associate's degree	**26%**	**$64,690**

(Source: Bureau of Labor Statistics)

The Bureau of Labor Statistics estimates that an additional 711,900 registered nurses will be hired in 2010–2020, which is the largest absolute increase in employment among all occupations. In 2010, about 93 percent of registered nurses employed nationwide held at least an associate's degree—the typical education needed for entry—and the variations among the 50 biggest metros are rather small. However, for bachelor's degree or above, substantial differences exist (see table 2-5).

First, unlike the other occupations discussed so far, the share of registered nurses holding at least a bachelor's degree is not necessarily higher in the metros with the highest concentration of registered nurses. At the same time, no metro stood out as having a particularly high concentration of registered nurses. This is to be expected since health-care services are typically in close proximity to clients.

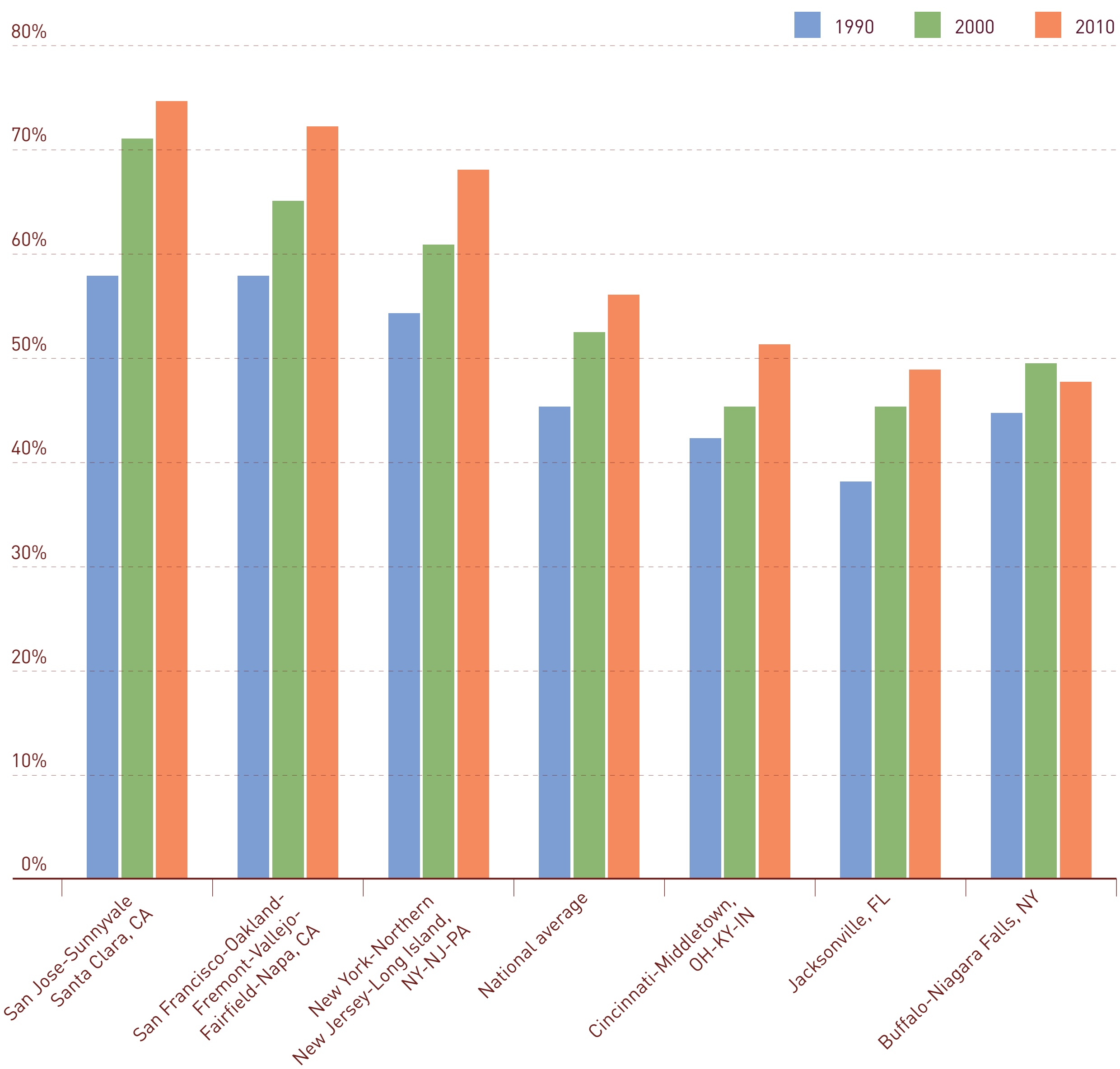
Second, the average registered nurse in metros where the general level of education attainment is high is more likely to hold at least a bachelor's degree. In the 10 best-educated large metros, nearly 66 percent of registered nurses have at least a bachelor's degree vs. 56 percent in the least-educated metros. This may suggest that better-educated clients tend to seek higher-quality health-care services delivered by better-educated providers.

Third, the nationwide improvement in educational attainment for registered nurses from 1990 to 2010 is due primarily to a larger percentage obtaining at least a bachelor's degree as the share of nurses with an associate's degree stayed almost constant nationally. At the regional level, the share of registered nurses with just an associate's degree has been declining in metros where the percentage with at least a bachelor's degree is high. In the San Jose region, for example, the share of registered nurses with just an associate's degree fell about 10 percentage points as more nurses obtained at least a bachelor's degree.

Hospitals remain the major employer, retaining approximately 63 percent of registered nurses nationwide in 2010. However, an increasing number of registered nurses are employed by providers other than hospitals, nursing, and personal care facilities, or medical offices and clinics.

FIGURE
2-5

Share of degree-holding registered nurses 25 or older who hold a bachelor's degree or higher



TABLE

2-5

Share of registered nurses 25 or older who hold a bachelor's degree or higher

50 most populous metropolitan areas (2010, 2000, 1990)

Metros with highest shares of registered nurses with a bachelor's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
Buffalo-Niagara Falls, NY	0.93	82.63	± 5.45	1	73.06	± 3.97	1	60.32	± 5.97	4
Hartford-West Hartford-East Hartford, CT	0.97	76.04	± 7.99	2	70.79	± 5.69	3	66.54	± 6.93	2
Louisville-Jefferson County, KY-IN	0.92	70.78	± 8.46	3	71.77	± 5.40	2	64.40	± 6.89	3
Boston-Cambridge-Quincy, MA-NH	0.86	67.32	± 3.88	4	57.45	± 2.72	5	48.59	± 3.94	11
Detroit-Warren-Livonia, MI	1.13	66.97	± 4.39	5	53.22	± 3.13	7	55.54	± 3.35	6
New York-Northern New Jersey-Long Island, NY-NJ-PA	0.82	64.26	± 1.93	6	59.47	± 1.31	4	55.95	± 1.53	5
Kansas City, MO-KS	1.04	62.78	± 6.21	7	51.45	± 4.77	8	47.08	± 5.80	14
Cincinnati-Middletown, OH-KY-IN	0.95	60.67	± 6.63	8	50.20	± 5.18	10	46.24	± 6.30	16
Cleveland-Elyria-Mentor, OH	0.87	60.48	± 6.75	9	47.04	± 4.62	16	38.04	± 5.78	25
Columbus, OH	1.09	60.31	± 7.39	10	46.30	± 5.76	18	37.10	± 7.57	27
Portland-Vancouver-Hillsboro, OR-WA	0.99	60.19	± 7.39	11	46.33	± 5.44	17	42.68	± 6.38	20
Minneapolis-St. Paul-Bloomington, MN-WI	1.00	58.14	± 5.71	12	48.63	± 3.84	13	35.32	± 5.32	31
Chicago-Joliet-Naperville, IL-IN-WI	0.96	57.79	± 3.26	13	48.85	± 2.33	11	45.21	± 2.80	18
San Diego-Carlsbad-San Marcos, CA	1.00	56.18	± 6.28	14	45.71	± 4.39	20	37.29	± 5.56	26
St. Louis, MO-IL	0.77	55.91	± 5.98	15	45.58	± 4.15	21	41.00	± 5.04	23
Baltimore-Towson, MD	1.01	55.78	± 5.96	16	50.73	± 4.22	9	54.18	± 4.56	7
Providence-New Bedford-Fall River, RI-MA	0.90	55.39	± 9.31	17	44.78	± 6.28	22	50.23	± 9.80	10
Las Vegas-Paradise, NV	0.85	55.36	± 8.00	18	43.83	± 6.60	23	46.10	± 9.93	17
Seattle-Tacoma-Bellevue, WA	1.12	55.12	± 5.94	19	42.39	± 4.24	25	28.69	± 5.47	48
Washington-Arlington-Alexandria, DC-VA-MD-WV	0.79	54.67	± 4.02	20	48.52	± 2.99	14	47.25	± 3.70	13
Milwaukee-Waukesha-West Allis, WI	1.02	53.50	± 8.39	21	40.04	± 5.61	29	36.00	± 6.60	29
Atlanta-Sandy Springs-Marietta, GA	0.74	52.25	± 4.34	22	42.84	± 3.35	24	46.52	± 4.55	15
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	0.97	51.97	± 4.34	23	45.78	± 2.84	19	44.26	± 3.29	19
Birmingham-Hoover, AL	1.05	51.87	± 11.33	24	48.79	± 7.56	12	50.60	± 8.08	8
Nashville-Davidson-Murfreesboro-Franklin, TN	1.14	51.67	± 9.02	25	41.20	± 6.52	27	41.80	± 7.94	21
National average		**48.53**	**± 0.60**		**42.34**	**± 0.41**		**39.95**	**± 0.49**	

Metros with lowest shares of registered nurses with a bachelor's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
Riverside-San Bernardino-Ontario, CA	1.07	50.82	± 5.58	26	36.76	± 4.31	31	35.31	± 5.50	32
Phoenix-Mesa-Glendale, AZ	0.86	50.31	± 5.84	27	42.27	± 4.39	26	36.66	± 6.02	28
Pittsburgh, PA	0.98	49.20	± 7.33	28	47.13	± 4.65	15	50.41	± 5.46	9
San Jose-Sunnyvale-Santa Clara, CA	0.78	49.03	± 9.14	29	35.64	± 6.38	33	29.84	± 7.91	47
Los Angeles-Long Beach-Santa Ana, CA	1.09	48.99	± 3.27	30	35.18	± 2.28	34	34.53	± 2.68	34
Memphis, TN-MS-AR	0.80	48.58	± 10.09	31	40.18	± 7.10	28	47.49	± 7.80	12
Indianapolis-Carmel, IN	0.76	48.29	± 8.15	32	56.92	± 5.08	6	67.62	± 5.43	1
Virginia Beach-Norfolk-Newport News, VA-NC	1.13	43.94	± 7.91	33	38.60	± 5.37	30	35.15	± 7.31	33
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.16	43.65	± 5.79	34	34.02	± 3.78	36	33.85	± 4.42	35
Richmond, VA	0.83	42.54	± 10.49	35	36.40	± 7.03	32	32.90	± 9.30	38
Charlotte-Gastonia-Rock Hill, NC-SC	1.17	40.22	± 8.33	36	32.77	± 6.14	39	32.20	± 8.56	41
Sacramento-Arden-Arcade-Roseville, CA	1.20	39.41	± 8.94	37	29.91	± 5.95	43	31.65	± 7.13	42
Salt Lake City-Ogden-Clearfield, UT	0.87	37.78	± 10.09	38	29.54	± 7.18	45	23.95	± 9.78	50
Raleigh-Cary-Durham-Chapel Hill, NC	1.00	36.15	± 9.63	39	32.58	± 7.22	40	25.45	± 11.06	49
Miami-Fort Lauderdale-Pompano Beach, FL	1.16	35.48	± 7.35	40	35.08	± 4.82	35	35.98	± 4.28	30
Tampa-St. Petersburg-Clearwater, FL	0.82	34.21	± 7.36	41	30.21	± 5.53	41	30.62	± 6.22	45
Orlando-Kissimmee-Sanford, FL	0.87	34.02	± 8.77	42	28.13	± 6.43	48	30.48	± 8.24	46
New Orleans-Metairie-Kenner, LA	1.07	33.65	± 12.90	43	32.79	± 7.09	38	31.02	± 8.10	44
Greensboro-Winston-Salem-High Point, NC	0.86	33.12	± 9.99	44	28.72	± 7.18	47	32.92	± 8.72	37
Oklahoma City, OK	0.93	32.90	± 13.26	45	33.52	± 7.96	37	41.14	± 8.93	22
Jacksonville, FL	1.02	32.85	± 10.90	46	29.83	± 7.45	44	32.30	± 9.43	40
San Antonio-New Braunfels, TX	0.90	31.94	± 8.45	47	29.46	± 6.05	46	33.13	± 7.22	36
Dallas-Fort Worth-Arlington, TX	0.90	29.06	± 4.74	48	30.17	± 3.27	42	39.39	± 4.15	24
Austin-Round Rock-San Marcos, TX	1.22	27.64	± 9.34	49	27.82	± 6.91	49	31.25	± 9.74	43
Houston-Sugar Land-Baytown, TX	0.97	27.42	± 4.92	50	26.26	± 3.34	50	32.58	± 4.20	39
National average		**48.53**	**± 0.60**		**42.34**	**± 0.41**		**39.95**	**± 0.49**	

Notes:
1. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
2. The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.
3. LQ stands for "location quotient," which measures the concentration of occupational employment in a metro using the nation as a benchmark.

PRIMARY SCHOOL TEACHERS

NATIONAL OUTLOOK		
Typical education needed for entry:	Projected employment growth, 2010-2020:	2010 median annual pay:
Bachelor's degree	**16.8%**	**$51,660**

(Source: Bureau of Labor Statistics)

Teachers are arguably the most important factor in educating the nation's workforce. Naturally, teachers are among the best-educated of all occupations. In 2010, almost half of employed primary school teachers nationwide had at least a master's degree, and about 94 percent hold at least a bachelor's degree. In addition to a bachelor's degree, primary public school teachers must have a state-issued license or certification.

Like registered nurses, primary school teachers are evenly distributed across the nation. Little variation exists among the 50 largest metros when it comes to their share of primary school teachers with at least a bachelor's degree. However, when we examine the share of teachers with advanced degrees, large differences emerge among the metros based on geography.

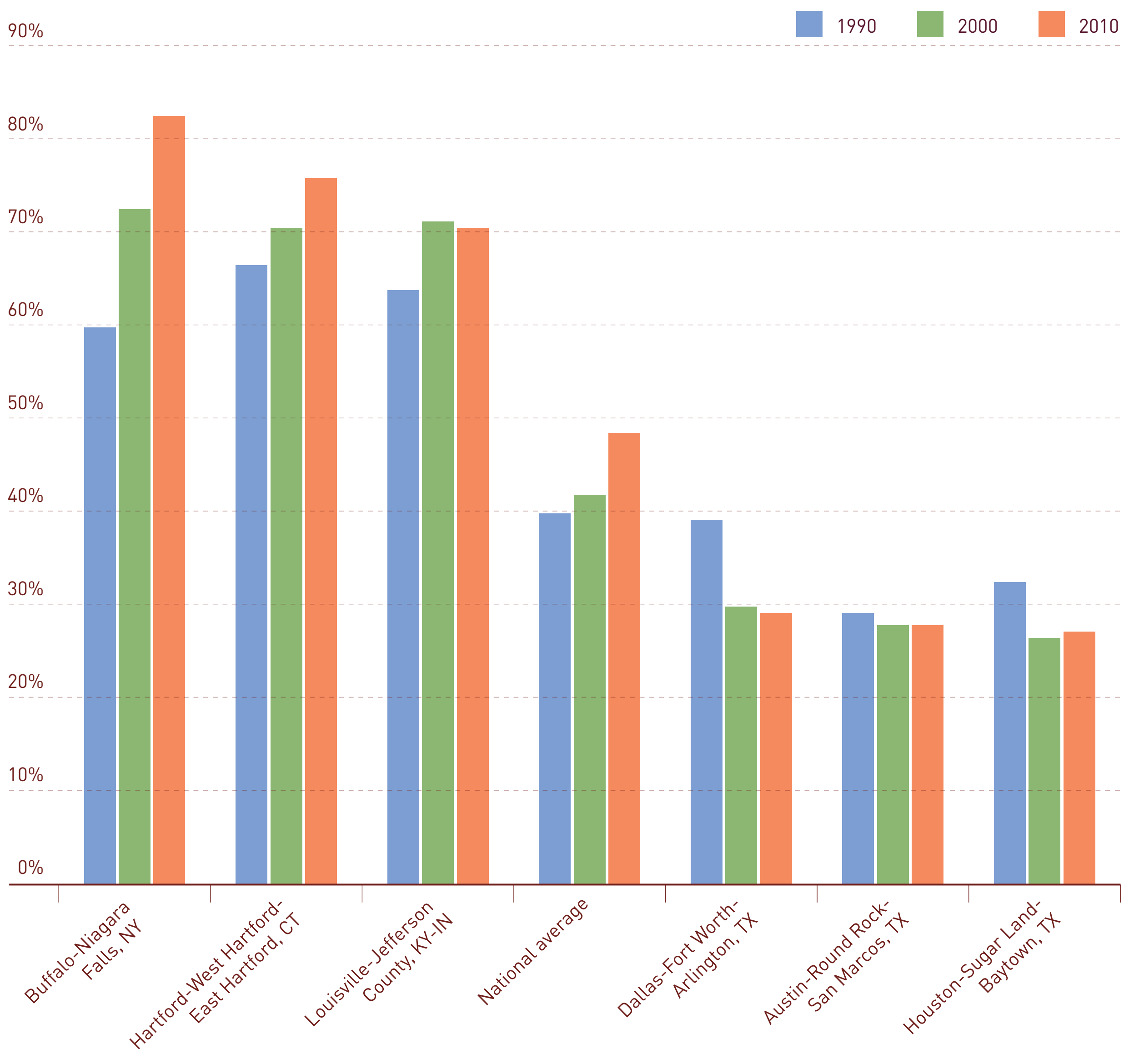
Generally, primary school teachers in Southern metros are least likely to have an advanced degree. In large Texas metros, for example, about three in 10 teachers have higher than a bachelor's degree. In contrast, teachers in Northeastern and Midwestern metros are most likely to hold at least a master's degree. In Buffalo-Niagara Falls, NY, for instance, about eight in 10 teachers had a master's degree or higher in 2010. Because of growth in advanced degrees, many of these metros witnessed a large decline between 1990 and 2000 in the share of primary school teachers with just a bachelor's degree.

However, the high share of advanced degree holders has more to do with state regulations than with market competition. For example, in eight states—Connecticut, Kentucky, Maryland, Michigan, Mississippi, Montana, New York, and Oregon—teachers need a master's degree (or complete coursework equivalent to a master's degree) to advance from a probationary to a professional license. And 16 states mandate that teachers receive extra pay once they have obtained a master's degree;[22] as a result, teachers in those states may be more motivated to pursue an advanced degree.

22. Raegen Miller and Marguerite Roza, "The Sheepskin Effect and Student Achievement: De-emphasizing the Role of Master's Degrees in Teacher Compensation," Center for American Progress, 2012; Sandi Jacobs et al., "2011 State Teacher Policy Yearbook," National Council on Teacher Quality, 2011.

FIGURE
2-6

Share of degree-holding primary school teachers 25 or older with a master's degree or higher



TABLE

2-6

Share of primary school teachers 25 or older with a master's degree or higher

50 most populous metropolitan areas (2010, 2000, 1990)

Metros with highest shares of primary school teachers with a master's degree or higher	2010				2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
Buffalo-Niagara Falls, NY	0.93	82.63	± 5.45	1	73.06	± 3.97	1	60.32	± 5.97	4
Hartford-West Hartford-East Hartford, CT	0.97	76.04	± 7.99	2	70.79	± 5.69	3	66.54	± 6.93	2
Louisville-Jefferson County, KY-IN	0.92	70.78	± 8.46	3	71.77	± 5.40	2	64.40	± 6.89	3
Boston-Cambridge-Quincy, MA-NH	0.86	67.32	± 3.88	4	57.45	± 2.72	5	48.59	± 3.94	11
Detroit-Warren-Livonia, MI	1.13	66.97	± 4.39	5	53.22	± 3.13	7	55.54	± 3.35	6
New York-Northern New Jersey-Long Island, NY-NJ-PA	0.82	64.26	± 1.93	6	59.47	± 1.31	4	55.95	± 1.53	5
Kansas City, MO-KS	1.04	62.78	± 6.21	7	51.45	± 4.77	8	47.08	± 5.80	14
Cincinnati-Middletown, OH-KY-IN	0.95	60.67	± 6.63	8	50.20	± 5.18	10	46.24	± 6.30	16
Cleveland-Elyria-Mentor, OH	0.87	60.48	± 6.75	9	47.04	± 4.62	16	38.04	± 5.78	25
Columbus, OH	1.09	60.31	± 7.39	10	46.30	± 5.76	18	37.10	± 7.57	27
Portland-Vancouver-Hillsboro, OR-WA	0.99	60.19	± 7.39	11	46.33	± 5.44	17	42.68	± 6.38	20
Minneapolis-St. Paul-Bloomington, MN-WI	1.00	58.14	± 5.71	12	48.63	± 3.84	13	35.32	± 5.32	31
Chicago-Joliet-Naperville, IL-IN-WI	0.96	57.79	± 3.26	13	48.85	± 2.33	11	45.21	± 2.80	18
San Diego-Carlsbad-San Marcos, CA	1.00	56.18	± 6.28	14	45.71	± 4.39	20	37.29	± 5.56	26
St. Louis, MO-IL	0.77	55.91	± 5.98	15	45.58	± 4.15	21	41.00	± 5.04	23
Baltimore-Towson, MD	1.01	55.78	± 5.96	16	50.73	± 4.22	9	54.18	± 4.56	7
Providence-New Bedford-Fall River, RI-MA	0.90	55.39	± 9.31	17	44.78	± 6.28	22	50.23	± 9.80	10
Las Vegas-Paradise, NV	0.85	55.36	± 8.00	18	43.83	± 6.60	23	46.10	± 9.93	17
Seattle-Tacoma-Bellevue, WA	1.12	55.12	± 5.94	19	42.39	± 4.24	25	28.69	± 5.47	48
Washington-Arlington-Alexandria, DC-VA-MD-WV	0.79	54.67	± 4.02	20	48.52	± 2.99	14	47.25	± 3.70	13
Milwaukee-Waukesha-West Allis, WI	1.02	53.50	± 8.39	21	40.04	± 5.61	29	36.00	± 6.60	29
Atlanta-Sandy Springs-Marietta, GA	0.74	52.25	± 4.34	22	42.84	± 3.35	24	46.52	± 4.55	15
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	0.97	51.97	± 4.34	23	45.78	± 2.84	19	44.26	± 3.29	19
Birmingham-Hoover, AL	1.05	51.87	± 11.33	24	48.79	± 7.56	12	50.60	± 8.08	8
Nashville-Davidson-Murfreesboro-Franklin, TN	1.14	51.67	± 9.02	25	41.20	± 6.52	27	41.80	± 7.94	21
National average		**48.53**	**± 0.60**		**42.34**	**± 0.41**		**39.95**	**± 0.49**	

Metros with lowest shares of primary school teachers with a master's degree or higher		2010			2000			1990		
Metropolitan area	LQ 2010	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank	Share of workers with master's or higher (%)	Margin of error (%)	Rank
Riverside-San Bernardino-Ontario, CA	1.07	50.82	± 5.58	26	36.76	± 4.31	31	35.31	± 5.50	32
Phoenix-Mesa-Glendale, AZ	0.86	50.31	± 5.84	27	42.27	± 4.39	26	36.66	± 6.02	28
Pittsburgh, PA	0.98	49.20	± 7.33	28	47.13	± 4.65	15	50.41	± 5.46	9
San Jose-Sunnyvale-Santa Clara, CA	0.78	49.03	± 9.14	29	35.64	± 6.38	33	29.84	± 7.91	47
Los Angeles-Long Beach-Santa Ana, CA	1.09	48.99	± 3.27	30	35.18	± 2.28	34	34.53	± 2.68	34
Memphis, TN-MS-AR	0.80	48.58	± 10.09	31	40.18	± 7.10	28	47.49	± 7.80	12
Indianapolis-Carmel, IN	0.76	48.29	± 8.15	32	56.92	± 5.08	6	67.62	± 5.43	1
Virginia Beach-Norfolk-Newport News, VA-NC	1.13	43.94	± 7.91	33	38.60	± 5.37	30	35.15	± 7.31	33
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	1.16	43.65	± 5.79	34	34.02	± 3.78	36	33.85	± 4.42	35
Richmond, VA	0.83	42.54	± 10.49	35	36.40	± 7.03	32	32.90	± 9.30	38
Charlotte-Gastonia-Rock Hill, NC-SC	1.17	40.22	± 8.33	36	32.77	± 6.14	39	32.20	± 8.56	41
Sacramento-Arden-Arcade-Roseville, CA	1.20	39.41	± 8.94	37	29.91	± 5.95	43	31.65	± 7.13	42
Salt Lake City-Ogden-Clearfield, UT	0.87	37.78	± 10.09	38	29.54	± 7.18	45	23.95	± 9.78	50
Raleigh-Cary-Durham-Chapel Hill, NC	1.00	36.15	± 9.63	39	32.58	± 7.22	40	25.45	± 11.06	49
Miami-Fort Lauderdale-Pompano Beach, FL	1.16	35.48	± 7.35	40	35.08	± 4.82	35	35.98	± 4.28	30
Tampa-St. Petersburg-Clearwater, FL	0.82	34.21	± 7.36	41	30.21	± 5.53	41	30.62	± 6.22	45
Orlando-Kissimmee-Sanford, FL	0.87	34.02	± 8.77	42	28.13	± 6.43	48	30.48	± 8.24	46
New Orleans-Metairie-Kenner, LA	1.07	33.65	± 12.90	43	32.79	± 7.09	38	31.02	± 8.10	44
Greensboro-Winston-Salem-High Point, NC	0.86	33.12	± 9.99	44	28.72	± 7.18	47	32.92	± 8.72	37
Oklahoma City, OK	0.93	32.90	± 13.26	45	33.52	± 7.96	37	41.14	± 8.93	22
Jacksonville, FL	1.02	32.85	± 10.90	46	29.83	± 7.45	44	32.30	± 9.43	40
San Antonio-New Braunfels, TX	0.90	31.94	± 8.45	47	29.46	± 6.05	46	33.13	± 7.22	36
Dallas-Fort Worth-Arlington, TX	0.90	29.06	± 4.74	48	30.17	± 3.27	42	39.39	± 4.15	24
Austin-Round Rock-San Marcos, TX	1.22	27.64	± 9.34	49	27.82	± 6.91	49	31.25	± 9.74	43
Houston-Sugar Land-Baytown, TX	0.97	27.42	± 4.92	50	26.26	± 3.34	50	32.58	± 4.20	39
National average		**48.53**	**± 0.60**		**42.34**	**± 0.41**		**39.95**	**± 0.49**	

Notes:
1. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The 2010 estimates are derived from the American Community Survey 2006-2010 five-year estimates, effectively representing the aggregate over the five-year period.
2. The margin of error is calculated at the 90 percent confidence interval using the design factor method. Metro rankings are compiled based on the point estimates. The comparison of closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.
3. LQ stands for "location quotient," which measures the concentration of occupational employment in a metro using the nation as a benchmark.

HUMAN CAPITAL-INTENSIVE OCCUPATIONS

To identify which types of occupations are key to elevating educational attainment in a metro, we compiled a list of "human capital-intensive occupations." The criterion require the share of occupation holders with at least a bachelor's degree and the share with an advanced degree to be higher than their respective averages across all occupations. We divided these occupations into five sub-categories:

- Executives and managers
- Business services
- Science, engineering, and technology
- Health services
- Education and public information

Table 2-7 shows the share of employment in all human capital-intensive occupations and in each of the five sub-categories for the 50 largest metros for 2006–2010. First, as expected, the order of the metros (from the highest to lowest share of employment in all human capital-intensive occupations) is very much in sync with the order in table 2-1, which ranks large metros by the share of employed workers holding at least a bachelor's degree. It suggests that the employment share of the occupations that tend to hire more educated workers can be used as an alternative measure to assess the quality of a metro's workforce.

Second, the best-educated large cities generally have the highest shares of three of the five sub-categories: executives and managers; business services; and science, engineering, and technology. In contrast, many of the best-educated metros have lower than average employment in the health services and education and public information categories, although the cross-metro variation of these two shares is small.

In a nutshell, the best-educated metropolitan areas are those that offer ample job opportunities to highly educated workers. What this table does not show is the difference in educational attainment for a specific occupation between metros. For example, as mentioned earlier, the more educated metros also tend to have better-educated registered nurses.

FIGURE
2-7

Share of employment in human capital-intensive occupations
Top 10 among the largest metropolitan areas (2006–2010)

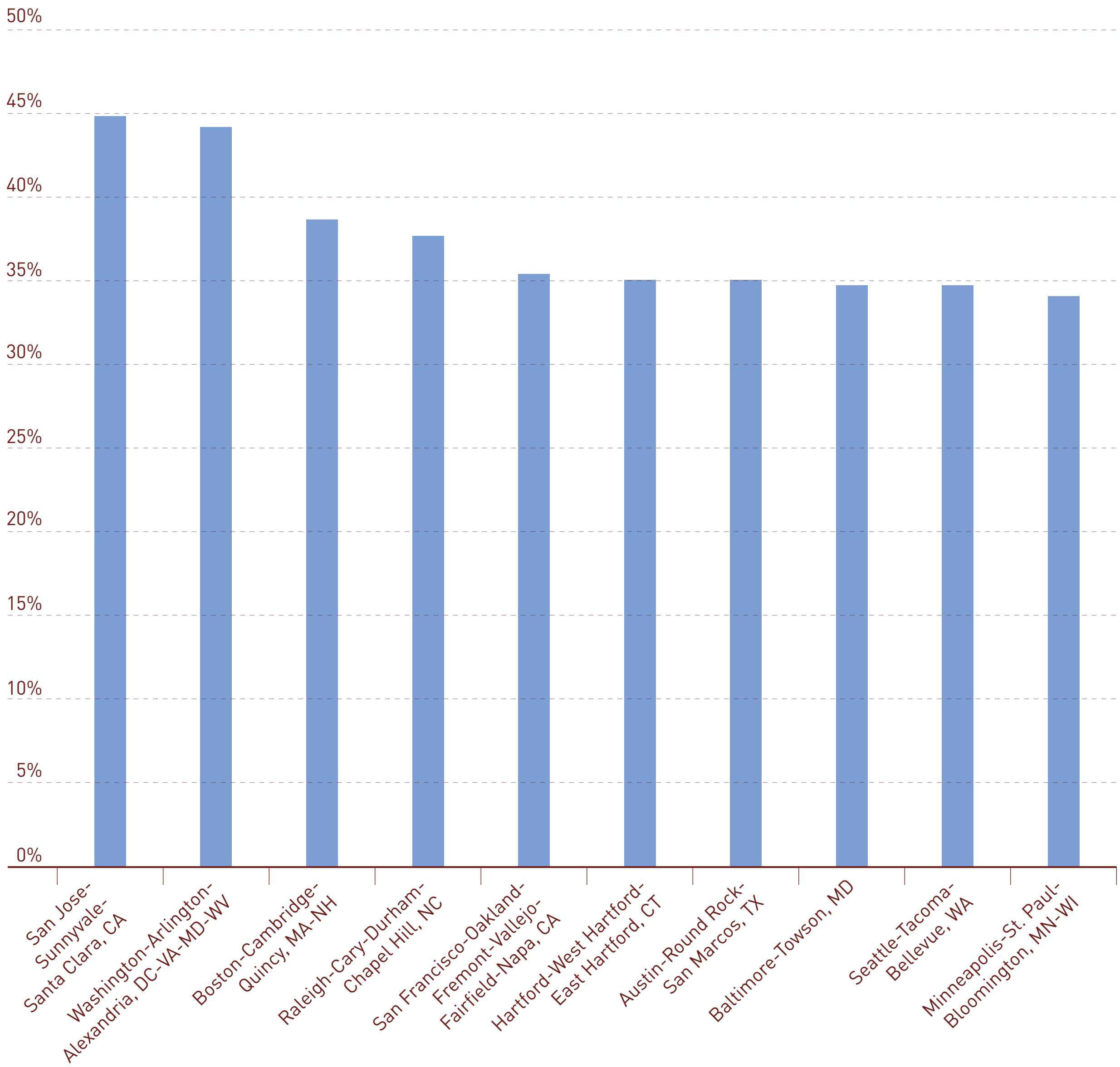


TABLE
2-7

Share of employment in human capital-intensive occupations
50 most populous metropolitan areas (2006–2010)

Metros with highest shares of employment in human capital-intensive occupations

Metropolitan area	Total	Executives and managers	Business services	Science, engineering, and technology	Health services	Education and public information
San Jose-Sunnyvale-Santa Clara, CA	45.07	12.73	6.36	16.48	3.21	6.28
Washington-Arlington-Alexandria, DC-VA-MD-WV	44.19	13.01	9.59	11.40	2.90	7.29
Boston-Cambridge-Quincy, MA-NH	38.79	10.63	6.79	8.47	4.45	8.44
Raleigh-Cary-Durham-Chapel Hill, NC	37.68	10.42	5.44	8.88	4.29	8.65
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	35.54	10.56	6.70	7.99	3.58	6.71
Hartford-West Hartford-East Hartford, CT	35.24	9.02	6.76	7.22	4.57	7.67
Austin-Round Rock-San Marcos, TX	35.18	10.26	6.06	8.51	2.74	7.62
Baltimore-Towson, MD	34.95	9.71	5.59	7.30	4.52	7.83
Seattle-Tacoma-Bellevue, WA	34.90	10.54	5.47	9.17	3.33	6.39
Minneapolis-St. Paul-Bloomington, MN-WI	34.31	9.95	6.61	7.25	3.58	6.91
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	33.34	9.08	5.72	5.77	4.60	8.18
New York-Northern New Jersey-Long Island, NY-NJ-PA	32.63	9.06	6.31	5.06	3.92	8.28
San Diego-Carlsbad-San Marcos, CA	32.51	9.10	5.59	7.54	3.42	6.87
Atlanta-Sandy Springs-Marietta, GA	32.47	10.13	5.88	6.31	2.90	7.25
Richmond, VA	32.24	9.52	6.15	5.44	3.94	7.18
Columbus, OH	32.19	9.17	6.11	6.08	3.89	6.94
Sacramento-Arden-Arcade-Roseville, CA	31.56	9.16	5.75	6.49	3.33	6.83
Chicago-Joliet-Naperville, IL-IN-WI	31.24	9.30	6.00	5.19	3.66	7.10
Kansas City, MO-KS	30.89	9.03	5.52	5.66	3.76	6.93
Portland-Vancouver-Hillsboro, OR-WA	30.80	9.00	5.00	6.64	3.64	6.52
Pittsburgh, PA	30.71	8.12	5.00	5.07	5.16	7.35
Dallas-Fort Worth-Arlington, TX	30.48	9.29	5.69	5.92	2.89	6.68
Cincinnati-Middletown, OH-KY-IN	30.34	8.55	5.05	5.18	4.12	7.45
Milwaukee-Waukesha-West Allis, WI	30.25	8.58	4.89	5.52	4.25	7.01
St. Louis, MO-IL	30.17	8.36	5.01	5.58	4.07	7.15
National average	**26.39**	**7.28**	**4.23**	**4.29**	**3.13**	**7.45**

Metros with lowest shares of employment in human capital-intensive occupations

Metropolitan area	Total	Executives and managers	Business services	Science, engineering, and technology	Health services	Education and public information
Charlotte-Gastonia-Rock Hill, NC-SC	30.02	9.41	5.37	4.93	3.28	7.03
Detroit-Warren-Livonia, MI	29.71	8.28	4.96	6.62	3.75	6.10
Indianapolis-Carmel, IN	29.71	8.70	5.10	5.26	4.23	6.42
Phoenix-Mesa-Glendale, AZ	29.65	9.02	5.19	5.49	3.42	6.54
Salt Lake City-Ogden-Clearfield, UT	29.53	8.54	5.44	5.95	3.19	6.42
Birmingham-Hoover, AL	29.49	8.52	5.33	4.26	4.53	6.86
Providence-New Bedford-Fall River, RI-MA	29.27	8.09	4.26	3.75	4.69	8.49
Houston-Sugar Land-Baytown, TX	29.20	8.40	5.26	5.84	2.97	6.74
Buffalo-Niagara Falls, NY	29.09	7.14	4.47	4.22	4.38	8.87
Cleveland-Elyria-Mentor, OH	28.99	8.25	5.05	4.71	4.52	6.45
Virginia Beach-Norfolk-Newport News, VA-NC	28.77	7.83	4.31	5.49	3.14	7.99
Nashville-Davidson-Murfreesboro-Franklin, TN	28.47	8.51	4.94	4.14	4.30	6.58
Los Angeles-Long Beach-Santa Ana, CA	28.32	8.74	5.34	4.82	2.93	6.49
Oklahoma City, OK	28.25	7.86	4.89	4.72	3.80	6.98
Tampa-St. Petersburg-Clearwater, FL	28.08	8.54	4.90	4.30	3.81	6.52
Jacksonville, FL	27.40	8.72	4.71	4.30	3.44	6.22
San Antonio-New Braunfels, TX	27.36	7.86	4.52	4.29	3.39	7.30
Memphis, TN-MS-AR	27.10	7.91	4.49	4.43	3.41	6.87
Louisville-Jefferson County, KY-IN	27.00	7.73	4.75	3.92	4.32	6.28
Miami-Fort Lauderdale-Pompano Beach, FL	26.93	8.77	5.08	3.56	3.51	6.02
Orlando-Kissimmee-Sanford, FL	26.26	8.39	4.40	4.49	3.08	5.90
New Orleans-Metairie-Kenner, LA	26.02	7.29	4.77	3.72	3.96	6.28
Greensboro-Winston-Salem-High Point, NC	26.02	7.52	3.96	3.37	3.57	7.59
Riverside-San Bernardino-Ontario, CA	21.97	6.64	2.97	2.40	2.84	7.13
Las Vegas-Paradise, NV	20.81	7.31	3.58	2.69	2.48	4.74
National average	**26.39**	**7.28**	**4.23**	**4.29**	**3.13**	**7.45**

Notes:
1. The shaded area denotes the top 10 point estimates within each sub-category of human capital-intensive occupations.
2. Authors' calculation based on census data (downloaded from the Integrated Public Use Microdata Series). The margin of error of each estimate is available upon request. The comparison of point estimates for closely positioned metropolitan areas should be treated with caution as the differences in estimated share of employment may not be statistically significant.

ON THE WEB

Data for each metro area can be found at ***www.matterofdegrees.net***

EDUCATIONAL ATTAINMENT AND REGIONAL ECONOMIC PROSPERITY

This section examines the statistical relationship between educational attainment (as measured by average years of schooling) and regional economic output. Specifically, we ran regression analyses using an unbalanced panel of 261 U.S. metropolitan areas spanning three decennial years from 1990 to 2010. Our study provides more empirical evidence of the role of skilled human capital in regional economic prosperity that can be used to inform the decisions of policymakers, educators, business executives, and civic leaders.

PAST RESEARCH

The quality of human capital is considered a key factor in a region's economic performance. As a result, many researchers have studied the benefits of investing in education.[25] At the microeconomic level, the Mincerian wage model[26] quantifies how much an individual's pay increases with an additional year of schooling—likely due to increased productivity. At the macroeconomic level, Robert Lucas[27] and Paul Romer[28] demonstrated how "human capital accumulation," or new education and training, benefit the overall economy.

Nobel laureate Lucas credited noted city anthropologist Jane Jacobs with informing the economics profession on the fundamental role of human capital in the growth process. Jacobs threaded together social and natural science theories to inform her thinking: "Beginning with the very start of a settlement and continuing for as long as the place maintains an economy, human effort is combined with imports. … And the most important ingredient qualitatively—although not always quantitatively—is human capital. That means skills, information, and experience—cultivated human potentialities—resulting from investments made by the public, by parents, by employers, and by individuals themselves."[29]

This concept—that the accumulation of skills over many years builds the stock of human capital, forms the source of innovative capacities, and drives the trajectory of regional economic performance—is behind a perceived economic shift to a knowledge-based economy. Today, the workforce's talent determines economic performance, while historically capital and land were the critical factors of production.

25. For example, see: Gary S. Becker, *Human Capital: A Theoretical and Empirical Analysis*, (New York and London: Columbia University Press, 1964).
26. Jacob Mincer, *Schooling, Experience, and Earnings* (New York: Columbia University Press: 1974).
27. Robert Lucas, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 1988, 22(1)3–42.
28. Paul Romer, "Endogenous Technological Change," *Journal of Political Economy*, 1990, 89(5): S71–S102.
29. Jane Jacobs, *The Nature of Economies* (New York: First Vintage Books Edition, 2001).

While the empirical evidence at the individual level generally suggests a positive return on increased educational attainment, earlier cross-country studies failed to clearly identify a positive association between education and economic output (e.g., Benhabib and Spiegel, 1994[30]; Pritchett, 2001[31]).In contrast, more recent macro studies, using improved data quality and estimation techniques, suggest that education brings positive returns to the aggregate economy (e.g., Cohen and Soto, 2007[32]; Turner et al., 2007[33]; Barro and Lee, 2010[34]).

Our study contributes to the literature by providing a richer and more updated understanding of occupational and industry dimensions of the empirical evidence involving the effect of educational attainment on economic prosperity in U.S. metropolitan areas. Our aim is to offer useful insight for stakeholders in U.S. governments, educational institutions, and businesses that will ultimately benefit from a higher, sustainable economic growth trajectory.

MODEL SPECIFICATION AND DATA

To investigate how human capital affects the economy, we assumed that the economy can be characterized by a Cobb-Douglas production function. (For the detailed methodology and process of the estimation, see appendix D.) The reduced-form model was estimated as follows:

$$\ln(\text{Real GDP per capita}_{it}) = \beta_0 + \beta_1 \ln(\text{Patents per thousand people}_{it}) + \beta_2 \text{Average years of schooling}_{it} + \beta_3 \text{Unemployment rate}_{it} + \beta_4 \text{Share of young workers}_{it} + \beta_d \text{Decade dummy}_t + \beta_s \text{State dummy}_i + \varepsilon_{it}$$

where β_0 is the constant term, β_1 to β_s are the coefficients for the independent variables, and ε_{it} is the error term.

Table 3-1 lists statistics and sources of the main variables of the above specification. The data is an unbalanced panel covering 261 U.S. metropolitan areas at 10-year intervals from 1990 to 2010. (For a complete set of variables used in the regressions, see table D-1 in appendix D.)

30. Jess Benhabib and Mark M. Spiegel, "The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data." *Journal of Monetary Economics*, October 1994, 34(2):143-74.
31. Lant Pritchett, "Where Has All the Education Gone?" *World Bank Economic Review*, 2001, 15 (3): 367-391.
32. Daniel Cohen and Marcelo Soto, "Growth and Human Capital: Good Data, Good Results." *Journal of Economic Growth*, 2007, 12(1):51-76.
33. Chad Turner et al., "Education and Income of the States of the United States: 1840-2000." *Journal of Economic Growth*, 2007, 12:101-158.
34. Robert J. Barro and Jong-Wha Lee, "A New Data Set of Educational Attainment in the World, 1950-2010." NBER working paper 15902, 2010.

TABLE 3-1 *Main data statistics and sources*

Main variables	Mean	Std. Dev.	Min.	Max.	Main data sources
Real GDP per capita	$35,845	$8,646	$15,387	$74,073	U.S. Bureau of Economic Analysis (BEA); Moody's Analytics
Patents per thousand people	0.38	0.53	0	8.19	Science-Metrix
Average years of schooling	13.36	0.51	11.08	14.78	U.S. Census Bureau; Integrated Public Use Microdata Series (IPUMS)
Unemployment rate	6.50%	3.28%	1.99%	26.30%	U.S. Bureau of Labor Statistics; Moody's Analytics
Share of young workers	16.00%	3.72%	6.35%	41.32%	U.S. Census Bureau; Integrated Public Use Microdata Series (IPUMS)

We begin with implementing the ordinary least squares (OLS) estimations commonly adopted in the related literature. However, as the OLS estimation might be subject to the endogeneity bias, we must treat the results with caution. On one hand, a higher level of educational attainment in a metro can lead to higher real GDP per capita. On the other hand, an increase in GDP per capita can lead to future increase in investment in education, which in turn creates higher level of educational attainment. This feedback effect may produce an upward bias in the OLS estimation. To deal with this issue, we employed the instrumental variable (IV) technique to mitigate the endogeneity bias with the two-stage-least-squares (2SLS) estimation.

To extend our analyses, we further checked whether different levels of educational attainment impacted the economic output differently. We first calculated average years of schooling for two groups—higher vs. lower educational attainment—and compared their returns. We then examined whether the industry composition was associated with different returns to education. We implemented this by interacting the employment shares of a number of major industry groups with average years of schooling.

RESULTS AND ANALYSES

Our regression results show that, overall, the average years of schooling have a positive and significant effect on real GDP per capita in U.S. metros. Moreover, the magnitude of the effect is in line with the findings of many other studies (e.g. Barro and Lee, 2010, and Turner et al., 2007).

Table F-1a in appendix F reports the outcome of OLS estimations controlling for state- and decade-specific effects for real GDP per capita. Column 1 shows the result of the benchmark model without adding additional control variables of unemployment rate and share of young workers. Columns 2 and 3 represent estimations that control for one or both of the above-mentioned variables. Coefficients of years of schooling in all the regressions are positive and significant, ranging from 8.5 percent to 12.4 percent by increasing educational attainment by one year, which is consistent with the literature.[35] In particular, controlling for both the unemployment rate and the share of young workers, the estimation in column 3 suggests that, on average, an extra year of schooling increases output per capita by about 10.5 percent.

35. For example, Barro and Lee found that returns to an additional year of schooling range from 5 percent to 12 percent, close to the typical Mincerian return estimates found in the literature.

The signs of coefficients of other economic factors are also consistent with expectations. The coefficient for patents is significantly positive, while the coefficients for unemployment rate and share of young workers are significantly negative. Those signs reflect the following economic rationale: A higher technology level proxied by more patents per thousand people usually leads to higher productivity, which increases economic output per unit of input; a lower unemployment rate indicates a favorable economic condition in which the output tends to grow; and a higher share of young workers implies a relatively low workforce experience level, which is linked to lower output. The expected signs of the variables above help verify the robustness of the specifications.

In addition, a case can be made that the direct estimates on the returns to investment in human capital, as measured by years of schooling, are conservative. For instance, a large share of patents reflects a high concentration of advanced degree holders in a metro economy.

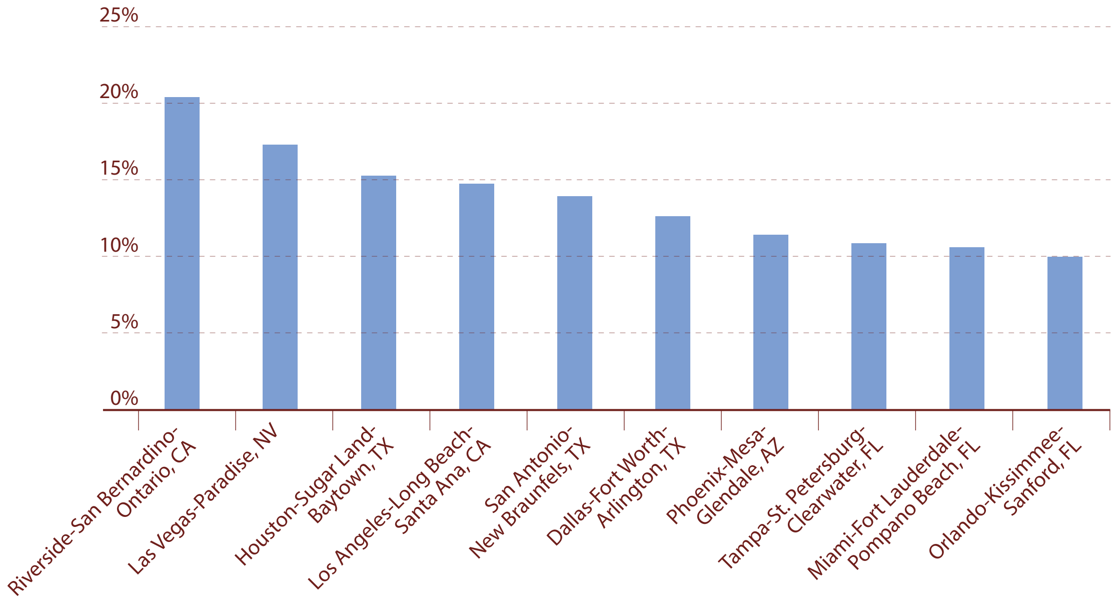
To deal with the potential endogeneity bias unaccounted for in the OLS estimation, we implemented the two-stage-least-squares estimations. Specifically, we used parental education—proxied by the 10-year lagged average years of schooling among workers 45 or older—to predict exogenous variations of contemporary averages of schooling, which are then, in theory, not confounded by the feedback effect from economic output to educational attainment. This choice of instrumental variable is similar to that used in the 2010 Barro and Lee study. Table F-2a shows that the coefficients of average years of schooling range from 9.6 percent to 15.3 percent, which are slightly higher than those in the previous OLS regressions in table F-1a. In particular, controlling for unemployment rate and share of young workers, a one-year increase in average years of schooling increases the real GDP per capita by 12.6 percent, resulting in a 2.1-point rise from the corresponding OLS estimation in table F-1a. However, the endogeneity test that compares the OLS and 2SLS estimations shows that they are not systematically different at the 5 percent significance level for all regressions, meaning that we can treat average years of schooling as an exogenous variable in our model. Since the OLS estimation is more efficient, we used the original OLS specifications for further analyses.

Based on the OLS specification, one extra year of schooling is associated with an approximately 10.5 percent increase in real GDP per capita as estimated in column 3 in table F-1a. We performed a counterfactual exercise on returns to education for each metro in our data set. Table F-5a in appendix F reports the hypothetical increases in real GDP per capita in 2010 for each metro if the workforce had completed the same average years of education as the Washington, D.C., area, which had the highest educational attainment (14.58 years) of the 30 most populous U.S. metros, holding other factors constant.

For example, in Los Angeles-Long Beach-Santa Ana, CA, the average educational attainment in 2010 was 13.3 years. Real GDP per capita in the metro would have leaped 14.4 percent—to $59,428 from $51,959—if average years of schooling had been the same as in the Washington metro. Among the 30 biggest metros, Riverside-San Bernardino-Ontario, CA, and Las Vegas-Paradise, NV, would hypothetically have seen the largest increases (20.0 percent and 17.9 percent, respectively) in GDP per capita because their average educational attainment is relatively low. Figure 3-1 shows the 10 big metros that would see the biggest increase in real GDP per capita if their education levels matched the Washington metro's. This exercise depicts how effectively metros could enhance economic output by advancing educational attainment.

FIGURE
3-1

10 large metros with the most to gain
Biggest increase in real GDP per capita if education levels matched Washington, D.C., metro



Sources: U.S. Bureau of Economic Analysis (BEA), Moody's Analytics, Milken Institute.

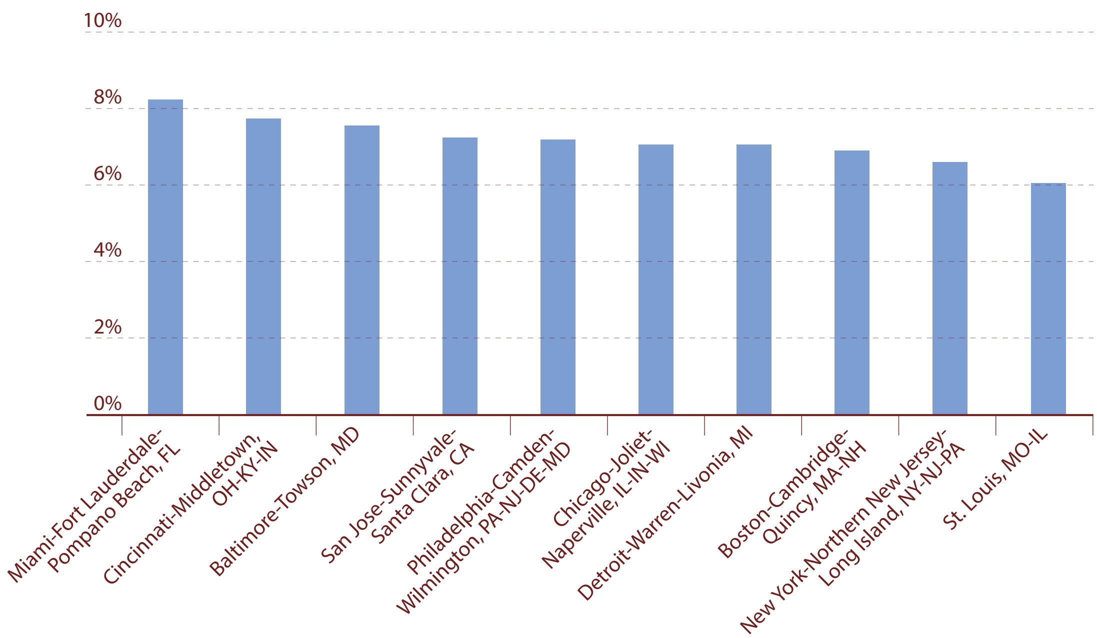
Another counterfactual exercise similarly demonstrates the high rate of return on investing in human capital. We held educational attainment constant at 1990 levels and allowed the other variables to rise at their actual levels. We then compared the difference between the actual and hypothetical values of real GDP per capita in 2010 to measure the contribution of increased educational attainment to each metro's economy. The results, shown in table F-5b in appendix F, indicate that the average increase in GDP per capita across the 217 metros would have been 4.7 percent or $1,774 by 2010. That equals an estimated gain of $510 billion for the 217 metros combined, after summing this calculation across all 217 metros for which there were data for 1990 and solving for the level of real GDP.

This simulation uncovered some interesting differences in performance among the metros. Several areas with low initial educational attainment had some of the largest gains by 2010. For example, Danville, VA, witnessed an increase of 1.1 in average years of schooling between 1990 and 2010, rising from 12.08 to 13.18. This boosted real GDP per capita in Danville by 12.2 percent or $3,440 by 2010. At the other extreme of initial educational attainment was Fort Collins-Loveland, CO. Its average years of schooling was 13.9 in 1990 and increased by 0.88 years by 2010. Though the increase was small, it gave the metro the highest attainment level in the nation, eclipsing both the San Jose and Washington, D.C., metropolitan areas. By 2010, the Colorado metro's real GDP per capita was higher by 9.6 percent or $3,551 due to the rise in average years of schooling. Figure 3-2 shows the 10 metros with the biggest percentage increases in real GDP per capita among the 30 most populous U.S. metros. This simulation demonstrates again the positive role of educational attainment on regional economic development.

FIGURE 3-2

10 large metros with the most to gain

Biggest increase in real GDP per capita attributable to the rise in average years of schooling between 1990 and 2010



Sources: U.S. Bureau of Economic Analysis (BEA), Moody's Analytics, Milken Institute.

We further examined whether different levels of educational attainment produce different returns. We replaced the overall average years of schooling with those calculated for two groups—those with at least a high school diploma and those with less than high school diploma. Column 3 in table F-3a shows that the return on education for the more educated group is as high as 17.4 percent while the return for the less educated group is effectively zero. The results suggest that additional education for those with at least a high school diploma brings more economic prosperity than does an additional year of education for those without a high school diploma. While there have been contrary findings on marginal returns of different levels of educational attainment[36], our study adds more empirical evidence to the discussion.

To test whether returns to education vary with a metro's industry composition, we re-examined the relationship by interacting the average years of schooling with shares of employment in several industry groups: manufacturing, health care, public administration, business services, and IT services. (See appendix E for the detailed list of industries for each group.) The results suggest that the industry mix matters. As shown in table F-4a, a higher share of employment in business or IT services industries contributes to a higher return on education, but the opposite is true for health care.

Specifically, an increase of one percentage point in the share of employment in business services and IT services raises real GDP per capita by 0.18 and 0.11 percentage point, respectively. The same increase in the share of health-care employment leads to a decrease of 0.10 percentage point in real GDP per capita. One possible reason is the operational difference among industries. For example, industries that produce or use more information technologies tend to be more productive (Jorgenson 2005[37]; Syverson 2011[38]), so a larger share of employment in those industries generates higher returns.

We then replaced real GDP per capita with real wages per worker as the dependent variable and applied the same sets of regressors to examine the relationship between educational attainment and income. The story is similar. For example, one extra year of schooling leads the real wages per worker to increase by 6 percent to 8.4 percent. The coefficients are positive and significant, and the range of magnitudes is consistent with the main literature. More detailed results can be found in appendix F.

36. For example, Barro and Lee (2010) find that the return on education increases with the level of education attainment for secondary and tertiary levels. But Psacharopoulos and Patrinos (2004) suggest that the classic pattern of falling return to education by level of education still exists. Source: Psacharopoulos, George and Harry A. Patrinos, "Returns to Investment in Education: A Further Update." *Education Economics*, 2004, 12(2): 111–135.

37. Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh, *Productivity, Volume 3: Information Technology and the American Growth Resurgence* (Cambridge and London, MIT Press: 2005).

38. Chad Syverson, "What Determines Productivity?" *Journal of Economic Literature*, 2011, 49(2): 326–365.

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Data for each metro area can be found at ***www.matterofdegrees.net***

CONCLUSION AND POLICY RECOMMENDATIONS

SUMMARY OF FINDINGS

This study investigated the variations in educational attainment across different occupations and the related industrial compositions in 261 U.S. metropolitan areas from 1990 to 2010. We also examined how education affects regional economic prosperity. Our major findings are the following:

Education and occupation/industry

- The differences among the metros in the educational attainment of their workforces are largely driven by the employment opportunities available for three types of occupations: executives and managers; business services; and science, engineering, and technology. While workers in health services or education and public information are also skilled, these occupations have less impact on regional disparities in education because they are distributed evenly across metros to be near the populations they serve.

- Even within the same occupation, educational attainment can vary greatly across U.S. metros. This is especially true when we compare the share of workers who hold a more advanced degree than typically required for their profession.

  - A metro's mix of industries may be a key factor in regional differences in educational attainment within occupations. In metros with clusters of high-skilled occupations (for example, the software developers and engineers of Silicon Valley), the share of workers holding at least a master's degree is much higher than average. This could be because of the more intense competition for employment. We also observed that these occupations are highly concentrated in a handful of major industries in these metros.

  - It is plausible that occupations in the three key categories—executives and managers; business services; and science, engineering, and technology—have spillover effects that promote and attract educated workers in other occupations as well. For example, we observed that educational attainment for some professional services, such as registered nurses, that are distributed more evenly across metros tended to be higher where the general workforce is also more educated.

Education and regional economic prosperity

- A strong association exists between education and prosperity in U.S. metros. For each extra year of schooling, on average, the real output per capita increases by about 10.5 percent, and real wages per worker increases by about 8.4 percent.

- Investing in new training and higher education will bring more regional prosperity, but the benefits vary with the level of education. Specifically, an additional year of education for workers with at least a high school diploma increases real GDP per capita by 17.4 percent and increases the real wages per worker by 17.8 percent. However, the increase in the per capita economic output for workers without a high school diploma is not significant. That is likely because the better-educated workers have skills that are more critical to improving industrial know-how and increasing productivity.

- Returns to education appear to be higher in some industries than in others. Specifically, a 1 percentage point increase in the share of employment in business services and IT services raises returns to education (measured in real GDP per capita) by 0.18 and 0.11 percentage points, respectively. For real wages per worker, the returns are even higher: 0.31 percentage points for business services and 0.20 for IT services. Meanwhile, a 1 percentage point increase in the share of health-care employment leads to a decrease of 0.10 percentage points in real GDP per capita (0.06 in real wages per worker). Again, this suggests that industry composition plays a role in regional economic prosperity.

POLICY RECOMMENDATIONS

Future economic growth is largely dependent on a well-educated workforce with the skills that industries require. Whether it is a city, county, metropolitan area, state, or nation, high levels of skilled human capital and continuing investment in education protect a location from being arbitraged by those seeking lower costs in a globally interconnected world. And human capital is not subject to the laws of diminishing returns: As educational inputs increase, economic output per capita rises more than proportionately.

Additionally, individuals in locations with highly educated populations become more productive and earn higher wages than those with the same educational attainment in locations with less- educated workforces. In other words, as others obtain more education around you, not only do their wages rise, but yours do as well.

But the United States is losing ground when it comes to educational advancement. In 2010, the U.S. ranked third among 34 OECD nations in the share of 55- to 64-year-olds with post-secondary education at about 41 percent. However, the U.S. ranked 13th in the share of 25- to 34-year-olds with post-secondary education, at 42 percent.[39] It is imperative that local and national policymakers, educators, and business executives reverse the trend.

39. Organization for Economic Cooperation and Development, "Education at a Glance 2012." The shares cited here are for associate's degree or higher. In terms of bachelor's degree or higher, the U.S. ranked first in the share of 55- to 64-year-olds and 11th in the share of 25- to 34-year-olds.

1. Make higher education more affordable.

- **Governments: Provide financial incentives and support to individuals and institutions to increase educational choice.** State appropriations per student at public four-year institutions have been declining since 2007. From 2009-2010 to 2010-2011 alone, states cut appropriations by 4 percent and increased tuition.[40] Federal and local governments must develop and implement strategic plans and budgets to adequately support postsecondary education. For example, public financing for higher education is largely discretionary in most states and easily subject to funding cuts during budget shortfalls; governments could pass legislation to make sure some ratio of tax dollars is spent on the educational system. Governments should further develop educational funding options and incentives such as personal income tax credits, grants, and student loans to help individuals pursue programs that best address their personal learning needs. Besides providing adequate financial support to the public higher education system, federal and local governments should also reduce barriers to private and for-profit educational options.

- **Educational institutions: Increase efficiency to reduce costs and improve affordability.** The cost of higher education is on the rise, and Americans are borrowing more to cope with it. Average tuition and fees at public four-year colleges rose 9 percent in 2009-10 and 7 percent in 2010-11 after inflation.[41] As a result, almost 26 percent of upper-middle-income households obtained student loans in 2010 vs. a record of about 20 percent in 2007.[42] Colleges and universities can do their part to make education more affordable by increasing operational efficiencies through technology and process improvements. Educational institutions should adopt best practices from the business community to increase cost-effectiveness and competitiveness. Universities and colleges should also increase their efforts to seek revenue from private grants and donations to defray some costs so students are not deterred by a high upfront price tag of education.

- **Businesses: Offer various kinds of financial sponsorship and paid internships.** Private investment in education will help achieve regional educational advancement and enhance the public image of donor companies. Businesses could provide tuition assistance, paid internships, and other types of scholarships to help students learn the right skills to meet market demands. Microsoft, the Coca-Cola Company, and Edison International all provide significant scholarship funds.[43] Companies such as AT&T, Walmart, Verizon, Cisco and FedEx offer tuition assistance to encourage educational advancement.

2. Make higher education more accessible.

- **Governments: Remove barriers to educational choices.** Government policies should promote student choice among diverse types of institutions and programs to meet individual needs. For example, technical and professional certification programs can be effective additions or alternatives to degree programs. To increase access, governments should provide funds to support educational technologies and programs that give students more flexibility and mobility.

40. College Board Advocacy and Policy Center, "Trends in College Pricing 2011."
41. Ibid.
42. Data are from a *Wall Street Journal* analysis based on the Federal Reserve 2010 Survey of Consumer Finances. Source: "College Debt Hits Well-Off: Upper-Middle-Income Households See Biggest Jumps in Student Loan Burden," *Wall Street Journal*, August 9, 2012. http://online.wsj.com/article/SB10000872396390444246904577575382576303876.html (accessed August 23, 2012).
43. Microsoft, http://careers.microsoft.com/careers/en/us/internships-scholarships.aspx#tab_urscholarship-1; Coca-Cola, www.coca-colacompany.com/citizenship/education.html; Edison International, https://www.scholarshipamerica.org/edisonscholars/ (all accessed October 10, 2012).

- **Educational institutions: Provide flexible formats conducive to adult learning.** Educational institutions should use more flexible program options and technology-enriched platforms that facilitate learning anytime, anywhere, especially for part-time students and working adults.

- **Businesses: Support employees who want to advance their education.** Educational advancement and job training add value to businesses and bring other benefits along the way. Businesses should support employees' professional growth by providing on-site learning opportunities and tuition assistance for work-related certifications and degrees. For example, Goldman Sachs founded Goldman Sachs University to bring experts from inside and outside the firm to teach courses that develop employees' professional skills.[44] Employers can further encourage education through flexible work hours and rewards for academic progress.

3. Increase higher education graduation rates.

- **Governments: Track dropout rates effectively and minimize obstacles to completion.** If the U.S. college graduation rate could have gone up from 57 percent to 90 percent in 2008, the OECD estimated that 59 percent, instead of 37 percent, of Americans would have obtained at least a bachelor's degree at some point during their lifetime. And it would have made the U.S. the second best educated OECD country, only after Finland.[45] To improve graduation rates, governments should develop better tracking systems to identify patterns and causes of dropping out, then act to minimize the obstacles to degree completion. Because one cause is financial pressure,[46] governments should provide financial support to students to keep the pipeline of skilled workers at full capacity. In addition, they can promote the best practices of colleges with high completion rates to establish guidelines for increasing student success.

- **Educational institutions: Offer effective counseling and appropriate credit transfers.** Universities and colleges should offer professional counseling and career services to better inform students about educational costs, processes, and job placement. This would help students to better allocate their resources to complete a degree on time. In addition, educational institutions should examine their policies on transferring credits to make sure coursework completed at other qualified institutions counts toward a degree, which will expedite graduation for some and open up classroom space to help others graduate on time.

- **Businesses: Create educational partnerships to demonstrate education's value.** Businesses should partner with educational institutions to provide work-study opportunities, internships, and job-entry programs to reinforce the relevance of education for career success.

4. Strengthen coordination between higher education institutions and industries.

- **Governments: Promote cooperative educational programs and develop industries that require well-educated workers.** Coordination between educational institutions and industries is crucial to turning the productivity embedded in education into real economic output. Governments should promote work-study and internship programs in the public and private sectors, and should recognize

44. "Goldman Sachs University," Careers Blog, Goldman Sachs. www.goldmansachs.com/careers/blog/posts/gs-university-post.html (accessed October 10, 2012).
45. Organization for Economic Cooperation and Development, "Education at a Glance 2010." The rates cited here are based on those for tertiary-type A programs, which in the United States are mostly offered at four-year institutions and lead to bachelor's degrees.
46. "Pathways to Prosperity," Harvard Graduate School of Education, February 2011.

and reward educational institutions that partner with businesses to increase educational and employment opportunities. In addition, local governments should encourage the development of industries that attract highly educated workers. As mentioned earlier, the high-tech industry in Charlotte, North Carolina, has led enrollment in engineering programs at local universities and colleges to jump more than 25 percent in four years.

- **Educational institutions, businesses, and industries: Collaborate on career pathway programs and discipline-specific sponsorships.** Collaboration between educational institutions and local industries helps develop programs and career pathways to assist students' transition into careers. Institutions should develop industry-specific certificate programs to promote skill development for specific jobs. Career services, workshops, job shadowing, and internships through business-education partnerships can increase students' workforce readiness. Job fairs could be open to not only soon-to-be graduates but also to students in the middle or the beginning of a program so they are better prepared for the future job market. Businesses could also provide financial sponsorships, such as the discipline-specific scholarships mentioned earlier.

5. Promote research and development.

- **Governments: Provide sufficient research and development funds.** Successful research and development (R&D) programs depend on highly educated human capital and can play a critical role in accelerating economic growth. Most of the 40 nations that are the world's biggest spenders on R&D are expected to increase their R&D budgets in 2012,[47] and it is crucial for the U.S. to be competitive. Various R&D tax credits could be used to incentivize private-sector investment. Making the federal R&D tax credit permanent would also help provide some certainty to firms in planning their R&D investment and likely encourage more of it.[48] The federal government should also set policies that support "technology transfer"—taking innovations developed by national labs to the industries that can commercialize them.

- **Educational institutions: Collaborate with industries.** Educational institutions offer great facilities and experts for R&D. However, they do not have the capacity that is available in industry. Educational institutions should actively seek collaborations with industries and communities to transform research innovations into products more efficiently. In addition, institutions should develop a pipeline of qualified graduates to meet the demand for future R&D opportunities in industry.

- **Businesses: Actively initiate innovative projects.** The private sector is a large funder of R&D. In 2012, U.S. industries are projected to spend more than twice as much as the federal government on R&D. Businesses should continue to take the lead by actively initiating innovative projects. Also, businesses and academic institutions should cooperate so their combined knowledge amplifies the economic returns, and to ensure a steady pipeline of qualified graduates to meet future R&D needs.

47. Battelle, press release, "Battelle R&D Magazine Annual Global Funding Forecast Predicts R&D Spending Growth Will Continue While Globalization Accelerates." December 16, 2011. www.battelle.org/media/news/2011/12/16/battelle-r-d-magazine-annual-global-funding-forecast-predicts-r-d-spending-growth-will-continue-while-globalization-accelerates (accessed October 8, 2012).
48. Ross DeVol and Perry Wong, "Jobs for America: Investments and Policies for Economic Growth and Competitiveness," Milken Institute, 2010, pp. 24-31.
49. Ross DeVol and Armen Bedroussian, "Mind-to-Market," Milken Institute, 2006, pp. 3-24.
50. Battelle 2011.

ON THE WEB

Data for each metro area can be found at ***www.matterofdegrees.net***

APPENDIXES

APPENDIX A: CONSTRUCTION OF DATA ON EDUCATIONAL ATTAINMENT BY METROPOLITAN AREA

To construct the data set of educational attainment by metropolitan area, we relied on the Public Use Microdata Samples (PUMS) collected and provided by the Census Bureau. Specifically, we downloaded from the Integrated Public Use Microdata Series (IPUMS)[51] the 5 percent decennial census data for 1990 and 2000, and the American Community Survey (ACS) five-year estimates for 2006-2010.[52] The major advantage of this approach is that IPUMS provides alternative variables of occupation and industry (OCC1990 and IND1990, respectively) that are consistently defined over time.[53] In addition, the PWMETRO variable can be readily used to identify the metropolitan area where a worker is employed (not necessarily the same as his/her place of residence).

However, there are two major concerns with regards to the PWMETRO variable.

First, to construct the panel data set utilized in the section "Educational Attainment and Regional Economic Prosperity," we needed to match up the metropolitan areas defined by PWMETRO with the current definition of metropolitan statistical area (MSA) that is adopted by other data series that we use for the analysis.[54] Our matching strategy is predominantly by MSA names. When conflicts arose or when there was not a match by name, we used the county components of each metropolitan area. Finally, because the matching process was not necessarily one-to-one, we chose to consolidate metropolitan areas that could not be uniquely matched in either of the definition files. By the end of the process, we had matched up 299 metropolitan areas, some of which did not contain observations for certain year(s). In the finalized panel data set, we kept 261 metropolitan areas, with a small fraction of them lacking observations in 1990.

Second, IPUMS stresses that PWMETRO does not completely identify a metropolitan area in many cases, with some cases more severe than others.[55] That is, some individuals who are employed in a metropolitan area are not assigned the corresponding PWMETRO code due to a technical issue in the identification process. Since the unidentified individuals may be very different from the rest of the employed, this can bias the estimates of educational attainment distribution.

51. http://usa.ipums.org/usa/.
52. When computing the average years of schooling for analysis in the section "Educational Attainment and Regional Economic Prosperity," we use the 2010 American Community Survey (ACS) one-year estimate. We opt for the 2006-2010 ACS data for analysis in "Educational Attainment by Occupation" because it has a much larger number of observations that 1) facilitate the further analysis by occupation and 2) increase the reliability of the estimates by lowering the margin of error.
53. The official classification systems such as the Standard Occupational Classification (SOC) System or the North American Industry Classification System (NAICS) are revised regularly and did not exist in 1990. (Although SOC was initially introduced in 1977, it was completely restructured in 1998.)
54. See the current MSA definition file provided by the Census Bureau at www.census.gov/population/metro/files/lists/2009/List1.txt.
55. http://usa.ipums.org/usa/volii/incompmetareas.shtml.

To assess how serious this bias may be, we compared for all metropolitan areas the percentage distribution of different levels of educational attainment (including less than high school graduate, high school graduate or equivalent, some college or associate's degree, bachelor's degree, and graduate or professional degree) that were computed by us with those provided in the Census 2000 EEO data, which is a special tabulation for the Equal Employment Opportunity Commission. We found that the two data series provided very similar estimates and that the deviations from the EEO data were more likely caused by issues other than the incomplete identification of metropolitan areas.

The computation of educational attainment was conducted in the following steps. First, we calculated the population counts for each sub-group (e.g., the number of employed management analysts holding at least a master's degree in Washington-Arlington-Alexandria, DC-VA-MD-WV), using the individual sampling weight for each observation in the data set. Based on the total and sub-group population counts, we then calculated the percentage distribution of different levels of educational attainment. The margin of error for each estimate was computed using the design factor method detailed in the technical documents provided by the Census Bureau for users of PUMS files.[56] For the analysis in the "Educational Attainment and Regional Economic Prosperity" section, we calculated the average years of schooling by assigning the total years of schooling for each level of educational attainment as listed in table A-1.

56. See, for example, "2006-2010 PUMS Accuracy of the Data" available at www.census.gov/acs/www/Downloads/data_documentation/pums/Accuracy/2006_2010AccuracyPUMS.pdf.

TABLE A-1: YEARS OF SCHOOLING

Level of educational attainment	Assigned years of schooling
No schooling completed	0
Nursery school to grade 4	2
Nursery school, preschool	0
Kindergarten	0
Grade 1, 2, 3, or 4	2.5
Grade 1	1
Grade 2	2
Grade 3	3
Grade 4	4
Grade 5, 6, 7, or 8	6.5
Grade 5 or 6	5.5
Grade 5	5
Grade 6	6
Grade 7 or 8	7.5
Grade 7	7
Grade 8	8
Grade 9	9
Grade 10	10
Grade 11	11
Grade 12	12
12th grade, no diploma	12
High school graduate or GED	12
Regular high school diploma	12
GED or alternative credential	12
Some college, but less than 1 year	12.5
1 year of college	13
1 or more years of college credit, no degree	13.5
2 years of college	14
Associate's degree, type not specified	14
Associate's degree, occupational program	14
Associate's degree, academic program	14
3 years of college	15
4 years of college	16
Bachelor's degree	16
5+ years of college	17
6 years of college (6+ in 1960-1970)	18
7 years of college	19
8+ years of college	20
Master's degree	18
Professional degree beyond a bachelor's degree	19.75
Doctoral degree	20

APPENDIX B: WEBTOOL

Our supplementary webtool (www.matterofdegrees.net) provides an online database for those who would like to assess the metro-specific educational profiles and major hiring industries for occupations beyond those discussed in the section "Educational Attainment by Occupation." See table B-1 for a list of all occupations available in the webtool.

Because different occupations have different educational profiles and entry requirements, some levels of educational attainment are irrelevant for certain occupations. (One obvious example is that a person with only a high school diploma cannot practice medicine.) We chose the most pertinent levels of educational attainment for each occupation based on its national distribution in 2010. More specifically, we ordered all individuals according to the level of educational attainment, from doctoral degree to less than high school. Then we identified the educational attainment of the individual at the 5th, 10th, 15th, 20th, 25th, 50th, and 75th percentiles, respectively. (We examined more percentiles at the upper end because we are interested in identifying advanced degree holders.)

Take physicians' assistants for example. The individuals located at the 5th to 10th percentile have a professional degree, at the 15th to 25th percentile a master's degree, at the 50th percentile a bachelor's degree, and at the 75th percentile an associate's degree. Therefore, the webtool shows four national statistics for this occupation: 12.62(±4.65)% have completed at least a professional degree, 42.22(±3.78)% have completed at least a master's degree, 71.71(±2.64)% have completed at least a bachelor's degree, and 84.74(±1.94)% have completed at least an associates' degree (for year 2010). For some occupations, however, since the vast majority of workers have similar levels of educational attainment, the webtool lists as few as two national statistics. For example, among physicians, 13.02(±1.53)% have completed a doctoral degree, while 95.42(±0.35)% have completed at least a professional degree.

In addition, the corresponding statistics for each occupation are also provided for the 50 most populous metropolitan areas. We ranked the metros based on the point estimates at each relevant level of educational attainment.[57] For each metropolitan area, we also provide the location quotient, which measures the concentration of occupation-specific employment using the nation as a benchmark, and a list of top hiring industries. As discussed in the section "Educational Attainment by Occupation" above, the composition of industries is key to why the educational profile of an occupation may vary greatly from city to city. In addition, the webtool compiles the most recent mean annual salary by occupation at both the national and the metro levels.[58] Readers will find that differences in educational attainment are a major factor in explaining cross-metro salary variations.

Finally, the webtool also lets users compare the educational profile of an occupation across time (1990, 2000, and 2010), across different metropolitan areas, and across different occupations for a metropolitan area in a given time period.

57. However, the comparison of metro rankings for closely ranked metropolitan areas should be treated with caution as the differences in estimated share of workers may not be statistically significant.

58. The salary information is based on the May 2011 occupational employment and wage estimates downloaded from the Bureau of Labor Statistics. We matched its metropolitan areas to those in the educational attainment data set using a procedure similar to that described in appendix A. We also matched the SOC code adopted in the BLS data to the occupation code OCC1990 created by IPUMS and used in our educational attainment data set. The matching relies mainly on the occupation crosswalk files downloadable on the IPUMS website.

TABLE B-1: LIST OF OCCUPATIONS USED IN DATA SET

Executive, Administrative, and Managerial Occupations
Chief Executives and Public Administrators
Financial Managers
Human Resources and Labor Relations Managers
Managers and Specialists In Marketing, Advertising, and Public Relations
Managers in Education and Related Fields
Managers of Medicine and Health Occupations
Managers of Food-Serving and Lodging Establishments
Managers of Properties and Real Estate
Funeral Directors
Managers of Service Organizations, Not Elsewhere Classified
Managers and Administrators, Not Elsewhere Classified
Management-related Occupations
Accountants and Auditors
Insurance Underwriters
Other Financial Specialists
Management Analysts
Personnel, HR, Training, and Labor Relations Specialists
Purchasing Agents and Buyers of Farm Products
Buyers, Wholesale and Retail Trade
Purchasing Managers, Agents, and Buyers, Not Elsewhere Classified
Business and Promotion Agents
Construction Inspectors
Inspectors and Compliance Officers, Outside Construction
Management Support Occupations
Professional Specialty Occupations
Engineers, Architects, and Surveyors
Architects
Engineers
Aerospace Engineers
Metallurgical and Materials Engineers, Variously Phrased
Petroleum, Mining, and Geological Engineers
Chemical Engineers
Civil Engineers
Electrical Engineers
Industrial Engineers
Mechanical Engineers
Engineers, Not Elsewhere Classified
Mathematical and Computer Scientists
Computer Systems Analysts and Computer Scientists
Operations and Systems Researchers and Analysts
Actuaries
Mathematicians and Mathematical Scientists
Natural Scientists
Physicists and Astronomers
Chemists
Atmospheric and Space Scientists
Geologists
Physical Scientists, Not Elsewhere Classified
Agricultural and Food Scientists
Biological Scientists
Foresters and Conservation Scientists
Medical Scientists
Health Diagnosing Occupations
Physicians
Dentists
Veterinarians
Optometrists
Podiatrists
Other Health and Therapy
Health Assessment and Treating Occupations
Registered Nurses
Pharmacists
Dietitians and Nutritionists
Therapists
Respiratory Therapists
Occupational Therapists
Physical Therapists
Speech Therapists
Therapists, Not Elsewhere Classified
Physicians' Assistants
Teachers, Postsecondary
Subject Instructors (HS/College)
Teachers, Except Postsecondary
Kindergarten and Earlier School Teachers
Primary School Teachers
Secondary School Teachers
Special Education Teachers
Teachers , Not Elsewhere Classified
Vocational and Educational Counselors
Librarians, Archivists, and Curators
Librarians
Archivists and Curators
Social Scientists and Urban Planners
Economists, Market Researchers, and Survey Researchers
Psychologists
Social Scientists, Not Elsewhere Classified
Urban and Regional Planners

BLS data to the occupation code OCC1990 created by IPUMS and used in our educational attainment data set. The matching relies mainly on the occupation crosswalk files downloadable on the IPUMS website.

TABLE B-1: LIST OF OCCUPATIONS USED IN DATA SET (continued)

Social, Recreation, and Religious Workers
Social Workers
Recreation Workers
Clergy and Religious Workers
Lawyers and Judges
Lawyers
Writers, Artists, Entertainers, and Athletes
Writers and Authors
Technical Writers
Designers
Musicians or Composers
Actors, Directors, Producers
Art Makers: Painters, Sculptors, Craft Artists, and Printmakers
Photographers
Dancers
Art/Entertainment Performers and Related
Editors and Reporters
Announcers
Athletes, Sports Instructors, and Officials
Technicians and Related Support Occupations
Health Technologists and Technicians
Clinical Laboratory Technologists and Technicians
Dental Hygienists
Health Record Tech Specialists
Radiologic Tech Specialists
Licensed Practical Nurses
Health Technologists and Technicians, Not Elsewhere Classified
Technologists and Technicians, Except Health
Engineering and Related Technologists and Technicians
Science Technicians
Technicians, Except Health, Engineering, and Science
Airplane Pilots and Navigators
Air Traffic Controllers
Broadcast Equipment Operators
Computer Software Developers
Programmers of Numerically Controlled Machine Tools
Legal Assistants, Paralegals, Legal Support, etc.
Sales Occupations
Supervisors and Proprietors of Sales Jobs
Sales Representatives, Finance and Business Services
Insurance Sales Occupations
Real Estate Sales Occupations
Financial Services Sales Occupations
Advertising and Related Sales Jobs
Sales Representatives, Commodities
Sales Engineers
Salespersons, Not Elsewhere Classified
Retail Sales Clerks
Cashiers
Door-to-Door Sales, Street Sales, and News Vendors
Sales-related Occupations
Sales Demonstrators/Promoters/Models
Administrative Support Occupations, Including Clerical
Supervisors, Administrative Support Occupations
Office Supervisors
Computer Equipment Operators
Computer and Peripheral Equipment Operators
Secretaries, Stenographers, and Typists
Secretaries
Typists
Information Clerks
Interviewers, Enumerators, and Surveyors
Hotel Clerks
Transportation Ticket and Reservation Agents
Receptionists
Records Processing Occupations, Except Financial
Correspondence and Order Clerks
Human Resources Clerks, Except Payroll and Timekeeping
Library Assistants
File Clerks
Records Clerks
Financial Records Processing Occupations
Bookkeepers and Accounting and Auditing Clerks
Payroll and Timekeeping Clerks
Billing Clerks and Related Financial Records Processing
Duplicating, Mail, and Other Office Machine Operators
Mail and Paper Handlers
Office Machine Operators, Not Elsewhere Classified
Communications Equipment Operators
Telephone Operators
Other Telecom Operators
Mail and Message Distributing Occupations
Postal Clerks, Excluding Mail Carriers
Mail Carriers for Postal Service
Mail Clerks, Outside of Post Office
Messengers
Material Recording, Scheduling, and Distributing Clerks
Dispatchers
Shipping and Receiving Clerks
Stock and Inventory Clerks
Meter Readers
Weighers, Measurers, and Checkers
Material Recording, Scheduling, Production, Planning, and Expediting Clerks

TABLE B-1: LIST OF OCCUPATIONS USED IN DATA SET (continued)

- Adjusters and Investigators
  - Insurance Adjusters, Examiners, and Investigators
  - Customer Service Reps, Investigators, and Adjusters, Except Insurance
  - Eligibility Clerks for Government Programs
  - Bill and Account Collectors
- Miscellaneous Administrative Support Occupations
  - General Office Clerks
  - Bank Tellers
  - Proofreaders
  - Data Entry Keyers
  - Statistical Clerks
  - Administrative Support Jobs, Not Elsewhere Classified

Private Household Occupations

- Housekeepers, Maids, Butlers, Stewards, and Lodging Quarters Cleaners

Protective Service Occupations

- Supervisors, Protective Service Occupations
  - Supervisors of Guards
- Firefighting and Fire Prevention Occupations
  - Firefighting, Prevention, and Inspection
- Police and Detectives
  - Police, Detectives, and Private Investigators
  - Other Law Enforcement: Sheriffs, Bailiffs, Correctional Institution Officers
- Guards
  - Crossing Guards and Bridge Tenders
  - Guards, Watchmen, Doorkeepers
  - Protective Services, Not Elsewhere Classified

Service Occupations, Except Protective and Household

- Food Preparation and Service Occupations
  - Bartenders
  - Waiters/Waitresses
  - Cooks, Variously Defined
  - Kitchen Workers
  - Waiter's Assistant
  - Misc. Food Prep Workers
- Health Service Occupations
  - Dental Assistants
  - Health Aides, Except Nursing
  - Nursing Aides, Orderlies, and Attendants
- Cleaning and Building Service Occupations, Except Households
  - Supervisors of Cleaning and Building Service
  - Janitors
  - Elevator Operators
  - Pest Control Occupations
- Personal Service Occupations
  - Supervisors of Personal Service Jobs, Not Elsewhere Classified
  - Barbers
  - Hairdressers and Cosmetologists
  - Recreation Facility Attendants
  - Guides
  - Ushers
  - Public Transportation Attendants and Inspectors
  - Baggage Porters
  - Welfare Service Aides
  - Child Care Workers
  - Personal Service Occupations, Not Elsewhere Classified

Other Agricultural and Related Occupations

- Farm Occupations, Except Managerial
  - Farm Workers
- Related Agricultural Occupations
  - Supervisors of Agricultural Occupations
  - Gardeners and Groundskeepers
  - Animal Caretakers Except on Farms
  - Graders and Sorters of Agricultural Products
  - Inspectors of Agricultural Products
- Forestry and Logging Occupations
  - Timber, Logging, and Forestry Workers
- Fishers, Hunters, and Trappers
  - Fishers, Hunters, and Kindred

Mechanics and Repairers

- Supervisors of Mechanics and Repairers

Mechanics and Repairers, Except Supervisors

- Vehicle and Mobile Equipment Mechanics and Repairers
  - Automobile Mechanics
  - Bus, Truck, and Stationary Engine Mechanics
  - Aircraft Mechanics
  - Small Engine Repairers
  - Auto Body Repairers
  - Heavy Equipment and Farm Equipment Mechanics
  - Industrial Machinery Repairers
  - Machinery Maintenance Occupations
- Electrical and Electronic Equipment Repairers
  - Repairers of Industrial Electrical Equipment
  - Repairers of Data Processing Equipment
  - Repairers of Household Appliances and Power Tools
  - Telecom and Line Installers and Repairers
  - Repairers of Electrical Equipment, Not Elsewhere Classified
  - Heating, Air-conditioning, and Refrigeration Mechanics
- Miscellaneous Mechanics and Repairers
  - Precision Makers, Repairers, and Smiths
  - Locksmiths and Safe Repairers

TABLE B-1: LIST OF OCCUPATIONS USED IN DATA SET (continued)

Repairers of Mechanical Controls and Valves
Elevator Installers and Repairers
Millwrights
Mechanics and Repairers, Not Elsewhere Classified
Construction Trades
Supervisors, Construction Occupations
Supervisors of Construction Work
Construction Trades, Except Supervisors
Masons, Tilers, and Carpet Installers
Carpenters
Drywall Installers
Electricians
Electric Power Installers and Repairers
Painters, Construction and Maintenance
Paperhangers
Plasterers
Plumbers, Pipe Fitters, and Steamfitters
Concrete and Cement Workers
Glaziers
Insulation Workers
Paving, Surfacing, and Tamping Equipment Operators
Roofers and Slaters
Sheet Metal Duct Installers
Structural Metal Workers
Drillers of Earth
Construction Trades, Not Elsewhere Classified
Precision Production Occupations
Production Supervisors or Foremen
Precision Metal-working Occupations
Tool and Die Makers and Die Setters
Machinists
Boilermakers
Precision Grinders and Filers
Patternmakers and Model Makers
Engravers
Precision Woodworking Occupations
Cabinetmakers and Bench Carpenters
Furniture and Wood Finishers
Precision Textile, Apparel, and Furnishings Machine Workers
Dressmakers and Seamstresses
Upholsterers
Shoe Repairers
Precision Workers, Assorted Materials
Hand Molders and Shapers, Except Jewelers
Optical Goods Workers
Dental Laboratory and Medical Appliance Technicians
Bookbinders
Precision Food Production Occupations
Butchers and Meat Cutters
Bakers
Batch Food Makers
Plant and System Operators
Water and Sewage Treatment Plant Operators
Power Plant Operators
Plant and System Operators, Stationary Engineers
Other Plant and System Operators
Machine Operators, Assemblers, and Inspectors
Machine Operators and Tenders, Except Precision
Metal-working and Plastic-working Machine Operators
Metal and Plastic Processing Machine Operators
Woodworking Machine Operators
Printing Machine Operators
Textile, Apparel, and Furnishings Machine Operators
Machine Operators, Assorted Materials
Fabricators, Assemblers, and Hand-working Occupations
Welders and Metal Cutters
Assemblers of Electrical Equipment
Production Inspectors, Testers, Samplers, and Weighers
Graders and Sorters In Manufacturing
Transportation and Material-moving Occupations
Motor Vehicle Operators
Supervisors of Motor Vehicle Transportation
Truck, Delivery, and Tractor Drivers
Bus Drivers
Taxi Drivers and Chauffeurs
Parking-lot Attendants
Transportation Occupations, Except Motor Vehicles
Rail Transportation Occupations
Water Transportation Occupations
Material-moving Equipment Operators
Helpers, Construction and Extractive Occupations
Freight, Stock, and Material Handlers

APPENDIX C: DETAILED LIST OF HUMAN CAPITAL-INTENSIVE OCCUPATIONS

Sub-category of human capital-intensive occupations	Detailed occupation
Executives and managers	Chief executives and public administrators
	Financial managers
	Human resources and labor relations managers
	Managers and specialists in marketing, advertising, and public relations
	Managers in education and related fields
	Managers in medicine and health occupations
	Managers in service organizations, not elsewhere classified
	Managers and administrators, not elsewhere classified
Business services	Accountants and auditors
	Other financial specialists
	Management analysts
	Personnel, HR, training, and labor relations specialists
	Purchasing managers, agents, and buyers, not elsewhere classified
	Business and promotion agents
	Inspectors and compliance officers, outside construction
	Management support occupations
	Lawyers
Science, engineering, and technology	Architects
	Engineers
	Mathematical and computer scientists
	Technicians, except health, engineering, science, and legal support
	Natural scientists
	Social scientists and urban planners
Health services	Health-diagnosing occupations
	Health-assessment and treating occupations
	Therapists
Education and public information	Teachers, postsecondary
	Teachers, except postsecondary
	Librarians, archivists, and curators
	Social, recreation, and religious workers

APPENDIX D: METHODOLOGY OF THE REGRESSIONS

To investigate how human capital affects the economy, we assume that the economy is characterized by a Cobb-Douglas production function with constant returns to scale.

$$Y_{it} = A_{it} K_{it}^{\alpha} H_{it}^{1-\alpha} \tag{3.1}$$

where *Y* is the output in economy i in time t, *A* is a measure of technology level or total factor productivity, *K* is the physical capital stock, *H* represents human capital stock, and α is the output elasticity of capital stock, which ranges from 0 to 1 and denotes the relative importance of *K* and *H* in the production process.

Setting *H*=*hL*, where h is the amount of human capital per capita and *L* is the total number of population or workers (full employment is assumed in the simple stylized model), the production function can be written as:

$$Y_{it} = A_{it} K_{it}^{\alpha} (hL)_{it}^{1-\alpha} \tag{3.2}$$

Transforming the above function into per capita terms yields the following function:

$$y_{it} = A_{it} k_{it}^{\alpha} h_{it}^{1-\alpha} \tag{3.3}$$

where *y* is the output per capita, *k* is the physical capital stock per capita, and *h* represents human capital per capita.

Some literature (Krueger and Lindahl, 2001, for example) suggests that controlling for capital might exacerbate the measurement error in education. In addition, the physical capital stock in our study is not available at the metro level, and the measurement error in interpolating the capital stock might bring more noise and enlarge the bias. So we adopted the form of capital stock in proportion to human capital as used in Turner et al. (2007) under the assumption of perfect competition in both goods and factor markets.

Under perfect competition, the representative firm of the economy faces the following profit-maximization problem:

$$\max_{k_{it}, h_{it}} \{A_{it} k_{it}^{\alpha} h_{it}^{1-\alpha} - r_t k_{it} - w_t h_{it}\} \tag{3.4}$$

where *r* and *w* are the rental rate per unit of physical capital and human capital, respectively.

Combining the first-order conditions with respect to the two arguments *k* and *h*, the optimal solution is such that the amount of physical capital chosen is in proportion to the amount of human capital chosen:

$$k_{it} = \left(\frac{w_t}{r_t}\right)\left(\frac{\alpha}{1-\alpha}\right) h_{it} \tag{3.5}$$

Substituting equation 3.5 into equation 3.3 yields:

$$y_{it} = A_{it} \left(\frac{w_t}{r_t}\left(\frac{\alpha}{1-\alpha}\right)\right)^{\alpha} h_{it} \tag{3.6}$$

Based on the Mincerian formulation used in the literature (Mincer, 1974; Klenow and Rodriguez-Clare, 1997[59]; Hall and Jones, 1999[60]; Turner et al., 2007; and Barro and Lee, 2010), human capital is assumed to be an exponential function of years of schooling:

$$h_{it} = e^{\theta S_{it}} \tag{3.7}$$

where *S* stands for average years of schooling, and θ corresponds to the returns to schooling.

Substituting equation 3.7 into equation 3.6 and taking the natural log of both sides of the equation, the production function becomes:

$$\ln y_{it} = \ln A_{it} + \alpha \ln\left(\frac{w_t}{r_t}\left(\frac{\alpha}{1-\alpha}\right)\right) + \theta S_{it} \tag{3.8}$$

To measure the relationship between output per capita and average years of schooling, we estimated the following based on equation 3.8:

$$\ln y_{it} = \beta_0 + \beta_1 \ln A_{it} + D_t + \beta_2 S_{it} + \varepsilon_{it} \tag{3.9}$$

where β_0 is the constant term. D_t is a time-specific term that summarizes $\alpha \ln\left(\frac{w_t}{r_t}\left(\frac{\alpha}{1-\alpha}\right)\right)$, which is identical across i and varies only with time. β_1 measures the marginal return to technological or productivity advancement, β_2 is the marginal return to an additional average year of schooling, and ε_{it} is the error term.

For the dependent variable, we set real GDP per capita in each metropolitan statistical area (MSA) as a proxy for economic output *y*. For the independent variables, we used number of patents per thousand people as a proxy for technology *A* in each metro and average years of schooling[61] calculated as a proxy for *S* in each metro.

We further add other economic variables to the basic model to control for other important factors that influence the economy. Two important variables are the unemployment rate and the share of young workers measured by percentage of workers age 16 through 24 over total employment. The unemployment rate is an important control that bridges real labor market conditions and the assumption of full employment in the stylized model. The share of young workers controls for workers' experience; the younger the workers are, the less experience they might have. Both control variables are expected to negatively affect economic output.

The specification so far might be subjected to omitted variable bias as suggested in Barro and Lee (2010), due to factors that we have not controlled for but have an impact on each metro's economic output. We can control for some of these factors by adding decade dummies to control for the time-variant and metro-invariant elements.[62] (For example, the decade dummies can in theory control for variations of capital stock over time.) We also add state dummies to control for the time invariant effect within the states as each individual state has its specific attributes such as income vs. sales tax policy and the generosity of unemployment benefits that are uniformly applied to its various metros.

59. Peter J. Klenow and Andres Rodriguez-Clare, "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?" in NBER Macroeconomics Annual (MIT Press, Cambridge: 1997), pp.73-103.
60. Robert Hall and Charles Jones, "Why Do Some Countries Produce So Much More Output Per Worker Than Others?" Quarterly Journal of Economics, February 1999, 114 (1): 83-116.
61. Following the literature (Turner et al., 2007), years of schooling are first assigned to each individual based on the educational attainment level, then the average years of schooling for each MSA are calculated.
62. The decade dummy also captures the D_t term in equation 3.9.

The final specification becomes:

$$\ln(\text{Real GDP per capita}_{it}) = \beta_0 + \beta_1 \ln(\text{Patents per thousand people}_{it}) + \beta_2 \text{Average years of schooling}_{it} + \beta_3 \text{Unemployment rate}_{it} + \beta_4 \text{Share of young workers}_{it} + \beta_d \text{Decade dummy}_t + \beta_s \text{State dummy}_i + \varepsilon_{it}$$

where β_0 is the constant term, β_1 to β_s are the coefficients for the independent variables, and ε_{it} is the error term.

We begin our estimations with implementing the above ordinary least squares (OLS) regression. However, the OLS estimation might be subject to the endogeneity bias. On one hand, a higher level of educational attainment in a metro can lead to higher real GDP per capita. On the other hand, an increase in GDP per capita can lead to future increase in investment in education, which in turn creates a higher level of educational attainment. This feedback effect may produce an upward bias in the OLS estimation as the orthogonality condition between the explanatory variable and the error term may not be satisfied. To deal with this issue, we employed the instrumental variable (IV) technique to mitigate the endogeneity bias with the two-stage-least-squares (2SLS) estimation.

Parental education is an often-used instrumental variable for educational attainment (e.g., Barro and Lee, 2010). As the educational attainment of the parents' generation is decided by their past investment in education, there theoretically would be no correlation between the parents' education and the contemporaneous output or the error term. At the same time, youngsters' education is most likely to be influenced by that of their parents, so correlations should exist between the two (which is confirmed in the first-stage regression). Therefore, parental education is a potentially valid IV for the educational attainment in our model.

As estimations with a weak instrument can be even more biased than the OLS estimates, at the minimum we need to examine the first-stage estimation, whether there exists a statistically significant correlation between the instrumental and instrumented variables or not. We do find that the coefficients of the instrument are significantly different from zero for all regressions. However, the endogeneity test that compares the OLS and 2SLS estimations show that they are not systematically different at the 5 percent significance level for all regressions. Because the OLS estimation is more efficient, we chose to use the original OLS specifications as the analyzing framework in this study.

All variables used in the regressions are listed in the following table.

TABLE D-1: DATA STATISTICS AND SOURCES

Variables	Mean	Std. Dev.	Min.	Max.	Main data sources
Real GDP per capita	$35,845	$8,646	$15,387	$74,073	U.S. Bureau of Economic Analysis; Moody's Analytics
Real wages per worker	28341	5380	13729	69789	U.S. Bureau of Economic Analysis; Moody's Analytics
Patents per thousand people	0.38	0.53	0	8.19	Science-Metrix
Average years of schooling (AYS)	13.36	0.51	11.08	14.78	U.S. Census Bureau; Integrated Public Use Microdata Series
Unemployment rate	6.50%	3.28%	1.99%	26.30%	U.S. Bureau of Labor Statistics; Moody's Analytics
Share of young workers	16.00%	3.72%	6.35%	41.32%	U.S. Census Bureau; Integrated Public Use Microdata Series
Parental education	12.88	0.91	8.68	14.99	U.S. Census Bureau; Integrated Public Use Microdata Series
AYS high school and above	14.92	0.28	14.05	15.95	U.S. Census Bureau; Integrated Public Use Microdata Series
AYS below high school	11.14	0.48	8.66	11.88	U.S. Census Bureau; Integrated Public Use Microdata Series
Employment share of manufacturing industry	12.86%	6.95%	1.34%	47.44%	U.S. Census Bureau; Integrated Public Use Microdata Series
Employment share of health care industry	9.91%	2.85%	2.93%	34.27%	U.S. Census Bureau; Integrated Public Use Microdata Series
Employment share of public administration industry	5.05%	3.00%	1.19%	22.96%	U.S. Census Bureau; Integrated Public Use Microdata Series
Employment share of business services industry	3.79%	1.01%	1.47%	7.03%	U.S. Census Bureau; Integrated Public Use Microdata Series
Employment share of IT services industry	3.51%	1.69%	0.95%	14.07%	U.S. Census Bureau; Integrated Public Use Microdata Series

APPENDIX E: DETAILED LIST OF INDUSTRIES INCLUDED IN THE REGRESSION ANALYSES

Industry group	Detailed industry
Manufacturing	Food and kindred products
	Tobacco manufactures
	Textile mill products
	Apparel and other finished textile products
	Paper and allied products
	Chemicals and allied products
	Petroleum and coal products
	Rubber and miscellaneous plastics products
	Leather and leather products
	Lumber and wood products, except furniture
	Furniture and fixtures
	Stone, clay, glass, and concrete products
	Metal industries
	Machinery and computing equipment
	Electrical machinery, equipment, and supplies
	Transportation equipment
	Professional and photographic equipment, and watches
	Toys, amusement, and sporting goods
	Miscellaneous manufacturing industries
	Manufacturing industries, not elsewhere classified
Health care	Offices and clinics of physicians
	Offices and clinics of dentists
	Offices and clinics of chiropractors
	Offices and clinics of optometrists
	Offices and clinics of health practitioners, not elsewhere classified
	Hospitals
	Nursing and personal-care facilities
	Health services, not elsewhere classified
Public administration	Executive and legislative offices
	General government, not elsewhere classified
	Justice, public order, and safety
	Public finance, taxation, and monetary policy
	Administration of human resources programs
	Administration of environmental quality and housing programs
	Administration of economic programs
	National security and international affairs
Business services	Advertising
	Services to dwellings and other buildings
	Personnel supply services
	Detective and protective services
	Business services, not elsewhere classified
	Legal services
	Accounting, auditing, and bookkeeping services
	Management and public relations services
IT services	Printing, publishing, and allied industries
	Radio and television broadcasting and cable
	Telephone communications
	Telegraph and miscellaneous communications services
	Computer and data-processing services
	Theaters and motion pictures
	Engineering, architectural, and surveying services
	Research, development, and testing services

APPENDIX F: TABLES OF REGRESSIONS AND COUNTERFACTUAL EXERCISES

Table F-1a: Returns to schooling on real GDP per capita

Real GDP per capita (ln form)	(1)	(2)	(3)
Average years of schooling	0.124***	0.085***	0.105***
	(0.024)	(0.023)	(0.022)
Patent (ln form)	0.074***	0.062***	0.047***
	(0.012)	(0.012)	(0.011)
Unemployment rate		-2.346***	-2.550***
		(0.427)	(0.478)
Share of young workers			-1.220***
			(0.240)
Decade 2000	0.177***	0.150***	0.139***
	(0.009)	(0.011)	(0.012)
Decade 2010	0.187***	0.301***	0.274***
	(0.014)	(0.023)	(0.025)
Constant	9.311***	9.951***	9.841***
	(0.340)	(0.333)	(0.316)
Observations	737	737	737
R-squared	0.660	0.682	0.705

Table F-1b: Returns to schooling on real wages per worker

Real wages per worker (ln form)	(1)	(2)	(3)
Average years of schooling	0.070***	0.060***	0.084***
	(0.021)	(0.021)	(0.020)
Patent (ln form)	0.068***	0.065***	0.048***
	(0.011)	(0.011)	(0.010)
Unemployment rate		-0.567*	-0.801**
		(0.338)	(0.379)
Share of young workers			-1.398***
			(0.334)
Decade 2000	0.099***	0.093***	0.080***
	(0.007)	(0.008)	(0.010)
Decade 2010	0.089***	0.117***	0.086***
	(0.011)	(0.020)	(0.026)
Constant	9.686***	9.841***	9.714***
	(0.290)	(0.305)	(0.280)
Observations	737	737	737
R-squared	0.551	0.553	0.607

Note:
All regressions are OLS (or IV) estimations with state and decade dummies based on decennial data (1990, 2000, and 2010). Coefficients for state dummies are not shown in the tables due to the limitation of space. *** p<0.01, ** p<0.05, * p<0.1

Table F-2a: Returns to schooling on real GDP per capita (IV*)

Real GDP per capita (ln form)	(1)	(2)	(3)
Average years of schooling	0.153***	0.096***	0.126***
	(0.029)	(0.030)	(0.030)
Patent (ln form)	0.068***	0.062***	0.044***
	(0.013)	(0.013)	(0.012)
Unemployment rate		-2.294***	-2.468***
		(0.466)	(0.503)
Share of young workers			-1.179***
			(0.238)
Decade 2000	0.172***	0.149***	0.139***
	(0.009)	(0.011)	(0.011)
Decade 2010	0.170***	0.288***	0.260***
	(0.014)	(0.027)	(0.029)
Endogeneity test of average years of schooling (P-Value)	0.090	0.510	0.160
Observations	683	683	683
R-squared	0.542	0.576	0.600

Table F-2b: Returns to schooling on real wages per worker (IV*)

Real wages per worker (ln form)	(1)	(2)	(3)
Average years of schooling	0.083***	0.071***	0.106***
	(0.023)	(0.024)	(0.023)
Patent (ln form)	0.066***	0.065***	0.044***
	(0.012)	(0.012)	(0.012)
Unemployment rate		-0.499	-0.707*
		(0.359)	(0.390)
Share of young workers			-1.405***
			(0.343)
Decade 2000	0.101***	0.096***	0.084***
	(0.006)	(0.007)	(0.010)
Decade 2010	0.077***	0.103***	0.069***
	(0.010)	(0.021)	(0.026)
Endogeneity test of average years of schooling (p-value)	0.090	0.510	0.160
Observations	683	683	683
R-squared	0.423	0.425	0.49

Note:
* We use parental education proxied by the 10-year lagged average years of schooling among workers 45 or older as the instrumental variable (IV) for average years of schooling and implement a two-stage-least-squares (2SLS) estimation. The first-stage estimations show the coefficients of the instrument are significantly different from zero. The endogeneity tests of average years of schooling show that, for most regressions, we couldn't reject the null hypothesis that average years of schooling can be treated as an exogenous variable.

Table F-3a: Returns to schooling by level of educational attainment on real GDP per capita

Real GDP per capita (ln form)	(1)	(2)	(3)
Average years of schooling high school and above	0.226***	0.173***	0.174***
	(0.045)	(0.044)	(0.041)
Average years of schooling below high school	0.054**	0.017	0.027
	(0.026)	(0.025)	(0.024)
Patent (ln form)	0.065***	0.052***	0.043***
	(0.013)	(0.013)	(0.012)
Unemployment rate		-2.512***	-2.762***
		(0.427)	(0.478)
Share of young workers			-1.033***
			(0.243)
Decade 2000	0.217***	0.180***	0.170***
	(0.012)	(0.014)	(0.015)
Decade 2010	0.236***	0.344***	0.329***
	(0.011)	(0.019)	(0.021)
Constant	6.994***	8.305***	8.328***
	(0.759)	(0.741)	(0.688)
Observations	737	737	737
R-squared	0.658	0.685	0.701

Table F-3b: Returns to schooling by level of educational attainment on real wages per worker

Real wages per worker (ln form)	(1)	(2)	(3)
Average years of schooling high school and above	0.191***	0.176***	0.178***
	(0.047)	(0.048)	(0.042)
Average years of schooling below high school	-0.006	-0.016	-0.004
	(0.024)	(0.023)	(0.023)
Patent (ln form)	0.052***	0.048***	0.038***
	(0.011)	(0.011)	(0.010)
Unemployment rate		-0.707**	-1.004***
		(0.327)	(0.363)
Share of young workers			-1.223***
			(0.341)
Decade 2000	0.134***	0.124***	0.112***
	(0.010)	(0.012)	(0.012)
Decade 2010	0.123***	0.154***	0.136***
	(0.009)	(0.016)	(0.021)
Constant	7.804***	8.173***	8.200***
	(0.753)	(0.778)	(0.673)
Observations	737	737	737
R-squared	0.569	0.572	0.614

Table F-4a: Returns to schooling, interacted by industry group, on real GDP per capita

Real GDP per capita (ln form)	(1)	(2)	(3)
Average years of schooling	0.103***	0.058*	0.092***
	(0.031)	(0.030)	(0.029)
Interaction (average years of schooling and manufacturing industry)	0.020	0.019	0.004
	(0.017)	(0.017)	(0.017)
Interaction (average years of schooling and health care industry)	-0.086***	-0.074**	-0.099***
	(0.032)	(0.030)	(0.030)
Interaction (average years of schooling and public adm. industry)	0.001	-0.001	-0.021
	(0.024)	(0.022)	(0.023)
Interaction (average years of schooling and business services industry)	0.247***	0.282***	0.178***
	(0.068)	(0.063)	(0.062)
Interaction (average years of schooling and IT services industry)	0.147***	0.146***	0.114***
	(0.042)	(0.043)	(0.044)
Patent (ln form)	0.036**	0.026*	0.023*
	(0.014)	(0.013)	(0.013)
Unemployment rate		-2.441***	-2.527***
		(0.356)	(0.384)
Share of young workers			-0.901***
			(0.275)
Decade 2000	0.180***	0.151***	0.144***
	(0.012)	(0.013)	(0.013)
Decade 2010	0.222***	0.333***	0.315***
	(0.019)	(0.024)	(0.025)
Constant	9.372***	10.068***	9.876***
	(0.396)	(0.383)	(0.371)
Observations	669	669	669
R-squared	0.705	0.728	0.736

Table F-4b: Returns to schooling, interacted by industry group, on real wages per worker

Real wages per worker (ln form)	(1)	(2)	(3)
Average years of schooling	-0.000	-0.014	0.016
	(0.025)	(0.025)	(0.025)
Interaction (average years of schooling and manufacturing industry)	0.033***	0.033***	0.021*
	(0.013)	(0.013)	(0.013)
Interaction (average years of schooling and health care industry)	-0.044	-0.040	-0.061**
	(0.030)	(0.030)	(0.029)
Interaction (average years of schooling and public adm. industry)	0.044***	0.044***	0.026*
	(0.015)	(0.015)	(0.015)
Interaction (average years of schooling and business services industry)	0.384***	0.394***	0.305***
	(0.063)	(0.062)	(0.065)
Interaction (average years of schooling and IT services industry)	0.225***	0.224***	0.198***
	(0.060)	(0.061)	(0.061)
Patent (ln form)	0.030***	0.027**	0.025**
	(0.011)	(0.011)	(0.011)
Unemployment rate		-0.725**	-0.798***
		(0.290)	(0.302)
Share of young workers			-0.773***
			(0.262)
Decade 2000	0.097***	0.088***	0.083***
	(0.009)	(0.010)	(0.010)
Decade 2010	0.112***	0.145***	0.130***
	(0.014)	(0.018)	(0.020)
Constant	10.181***	10.387***	10.223***
	(0.319)	(0.328)	(0.317)
Observations	669	669	669
R-squared	0.685	0.688	0.699

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Abilene, TX	35217	39822	4605	13.1%	23224	25612	2387	10.3%	13.41
Akron, OH	36237	39034	2797	7.7%	30383	32236	1853	6.1%	13.87
Albany-Schenectady-Troy, NY	52363	54311	1947	3.7%	33682	34676	993	2.9%	14.23
Albuquerque, NM	37823	41329	3506	9.3%	30947	33210	2263	7.3%	13.73
Alexandria, LA	34600	40274	5674	16.4%	26318	29701	3383	12.9%	13.13
Allentown-Bethlehem-Easton, PA-NJ	34265	37433	3168	9.2%	31214	33490	2277	7.3%	13.74
Altoona, PA	37809	43288	5479	14.5%	26215	29197	2982	11.4%	13.29
Amarillo, TX	40179	46774	6595	16.4%	26095	29451	3357	12.9%	13.13
Anchorage, AK	54356	57472	3116	5.7%	37349	39044	1695	4.5%	14.05
Ann Arbor, MI	48159	48320	162	0.3%	33780	33870	90	0.3%	14.55
Anniston-Oxford, AL	34376	39607	5231	15.2%	27354	30620	3266	11.9%	13.23
Appleton-Oshkosh-Neenah, WI	41222	46026	4804	11.7%	30726	33545	2818	9.2%	13.53
Asheville, NC	34282	37123	2841	8.3%	23734	25287	1553	6.5%	13.82
Atlanta-Sandy Springs-Marietta, GA	42760	45671	2910	6.8%	35021	36906	1885	5.4%	13.95
Atlantic City-Hammonton, NJ	45183	51515	6332	14.0%	30541	33903	3362	11.0%	13.33
Augusta-Richmond County, GA-SC	31476	34286	2810	8.9%	28190	30176	1986	7.0%	13.76
Austin-Round Rock-San Marcos, TX	43812	46942	3130	7.1%	34110	36037	1926	5.6%	13.92
Bakersfield-Delano, CA	40494	51261	10767	26.6%	32304	38975	6671	20.6%	12.33
Baltimore-Towson, MD	47737	50338	2601	5.4%	38079	39722	1643	4.3%	14.07
Baton Rouge, LA	42511	46798	4287	10.1%	29715	32077	2362	7.9%	13.66
Beaumont-Port Arthur, TX	49004	58910	9905	20.2%	31172	36093	4921	15.8%	12.82
Bellingham, WA	40511	42661	2150	5.3%	26338	27445	1107	4.2%	14.09
Billings, MT	38685	42013	3328	8.6%	26804	28625	1820	6.8%	13.79
Binghamton, NY	44647	48988	4341	9.7%	29505	31767	2262	7.7%	13.69
Birmingham-Hoover, AL	37212	39921	2709	7.3%	30903	32681	1778	5.8%	13.91
Bloomington, IN	35836	37277	1441	4.0%	23850	24611	760	3.2%	14.20
Bloomington-Normal, IL	56339	59243	2904	5.2%	35743	37203	1459	4.1%	14.10
Boise-Nampa, ID	35266	38022	2757	7.8%	27508	29207	1699	6.2%	13.86
Boston-Cambridge-Quincy, MA-NH	58892	59145	253	0.4%	45104	45258	154	0.3%	14.54
Bremerton-Silverdale, WA	35536	38843	3308	9.3%	31896	34238	2342	7.3%	13.73
Bridgeport-Stamford-Norwalk, CT	63726	65355	1629	2.6%	50285	51305	1021	2.0%	14.34

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Brownsville-Harlingen, TX	24619	31818	7199	29.2%	20397	25019	4622	22.7%	12.13
Buffalo-Niagara Falls, NY	50264	53354	3091	6.1%	30453	31934	1482	4.9%	14.01
Cape Coral-Fort Myers, FL	29211	33663	4452	15.2%	25715	28789	3074	12.0%	13.23
Cedar Rapids, IA	48666	51954	3288	6.8%	31851	33552	1702	5.3%	13.96
Champaign-Urbana, IL	45445	46395	950	2.1%	27917	28381	464	1.7%	14.38
Charleston-North Charleston-Summerville, SC	34364	36746	2382	6.9%	28350	29904	1554	5.5%	13.94
Charlotte-Gastonia-Rock Hill, NC-SC	47259	51461	4201	8.9%	35952	38475	2523	7.0%	13.77
Chattanooga, TN-GA	39356	44310	4954	12.6%	28200	30992	2792	9.9%	13.45
Chicago-Joliet-Naperville, IL-IN-WI	46944	49856	2913	6.2%	38615	40510	1896	4.9%	14.00
Chico, CA	36342	40545	4203	11.6%	23587	25734	2148	9.1%	13.54
Cincinnati-Middletown, OH-KY-IN	39750	42473	2722	6.8%	33478	35291	1813	5.4%	13.95
Clarksville, TN-KY	26095	28920	2825	10.8%	30622	33234	2611	8.5%	13.60
Cleveland-Elyria-Mentor, OH	42174	45519	3345	7.9%	33160	35238	2078	6.3%	13.85
College Station-Bryan, TX	35298	37605	2307	6.5%	24609	25881	1272	5.2%	13.97
Colorado Springs, CO	37422	39917	2495	6.7%	32322	34026	1705	5.3%	13.96
Columbia, MO	38433	38085	-347	-0.9%	26071	25883	-188	-0.7%	14.66
Columbia, SC	36830	38895	2065	5.6%	28379	29638	1260	4.4%	14.06
Columbus, OH	43195	45786	2591	6.0%	32868	34428	1560	4.7%	14.02
Corpus Christi, TX	42350	51204	8854	20.9%	28035	32610	4575	16.3%	12.77
Dallas-Fort Worth-Arlington, TX	46598	52358	5760	12.4%	35752	39229	3476	9.7%	13.47
Danville, VA	31546	36548	5003	15.9%	23753	26707	2954	12.4%	13.18
Davenport-Moline-Rock Island, IA-IL	42950	47003	4054	9.4%	31688	34047	2359	7.4%	13.72
Dayton-Springfield, OH	35223	38384	3161	9.0%	30822	33005	2183	7.1%	13.76
Decatur, AL	28636	34768	6132	21.4%	25190	29397	4208	16.7%	12.73
Decatur, IL	48836	54262	5426	11.1%	32135	34947	2812	8.8%	13.57
Deltona-Daytona Beach-Ormond Beach, FL	26638	30162	3524	13.2%	25685	28356	2671	10.4%	13.39
Des Moines-West Des Moines, IA	55447	59733	4286	7.7%	33762	35824	2062	6.1%	13.87
Detroit-Warren-Livonia, MI	37766	40211	2445	6.5%	35443	37259	1815	5.1%	13.98
Duluth, MN-WI	34659	36786	2127	6.1%	26901	28208	1306	4.9%	14.01
Eau Claire, WI	38627	43271	4644	12.0%	25231	27617	2387	9.5%	13.50

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
El Paso, TX	29774	35701	5928	19.9%	25245	29172	3926	15.6%	12.85
Elkhart-Goshen, IN	48212	58933	10721	22.2%	28744	33727	4983	17.3%	12.67
Erie, PA	37735	41954	4220	11.2%	26628	28973	2345	8.8%	13.57
Eugene-Springfield, OR	32771	35296	2525	7.7%	25297	26837	1540	6.1%	13.87
Fayetteville, NC	34842	38966	4124	11.8%	34381	37584	3203	9.3%	13.51
Fayetteville-Springdale-Rogers, AR-MO	33960	39015	5055	14.9%	30373	33921	3548	11.7%	13.26
Flint, MI	26319	27994	1674	6.4%	26225	27545	1320	5.0%	13.99
Florence-Muscle Shoals, AL	27863	31804	3941	14.1%	23355	25949	2594	11.1%	13.32
Fort Collins-Loveland, CO	40369	39526	-843	-2.1%	27187	26734	-453	-1.7%	14.78
Fort Wayne, IN	40992	46096	5104	12.5%	29963	32897	2934	9.8%	13.46
Fresno, CA	36459	43962	7503	20.6%	27755	32214	4459	16.1%	12.80
Gainesville, FL	40556	41897	1342	3.3%	28720	29474	754	2.6%	14.27
Grand Rapids-Wyoming, MI	41097	45145	4048	9.9%	29485	31775	2290	7.8%	13.68
Greeley, CO	31161	35658	4496	14.4%	26044	28995	2950	11.3%	13.29
Greensboro-Winston-Salem-High Point, NC	44041	49249	5208	11.8%	30003	32796	2792	9.3%	13.51
Greenville-Mauldin-Easley-Spartanburg-Anderson, SC	33199	37389	4190	12.6%	27637	30380	2743	9.9%	13.45
Gulfport-Biloxi, MS	34812	39426	4615	13.3%	28456	31421	2965	10.4%	13.39
Hagerstown-Martinsburg, MD-WV	30385	34700	4315	14.2%	27848	30953	3106	11.2%	13.31
Harrisburg-Lebanon-Carlisle, PA	46960	51497	4536	9.7%	32392	34860	2468	7.6%	13.70
Hartford-West Hartford-East Hartford, CT	71175	73898	2722	3.8%	40297	41520	1223	3.0%	14.22
Hickory-Lenoir-Morganton, NC	32197	37862	5666	17.6%	23632	26888	3255	13.8%	13.03
Honolulu, HI	46923	50274	3350	7.1%	33235	35111	1876	5.6%	13.92
Houma-Bayou Cane-Thibodaux, LA	50280	62227	11947	23.8%	34121	40434	6312	18.5%	12.55
Houston-Sugar Land-Baytown, TX	53050	60979	7929	14.9%	39861	44536	4675	11.7%	13.25
Indianapolis-Carmel, IN	46453	50355	3902	8.4%	32898	35080	2182	6.6%	13.81
Jackson, MI	29538	32890	3352	11.3%	27419	29869	2450	8.9%	13.55
Jackson, MS	37838	40562	2724	7.2%	27205	28753	1548	5.7%	13.92
Jacksonville, FL	39954	43860	3907	9.8%	32070	34543	2473	7.7%	13.69
Jacksonville, NC	28391	33066	4675	16.5%	33538	37866	4328	12.9%	13.13
Janesville, WI	27747	31843	4096	14.8%	27544	30735	3191	11.6%	13.27
Johnson City-Kingsport-Bristol, TN-VA	33190	37167	3977	12.0%	26032	28487	2455	9.4%	13.50
Johnstown, PA	34785	39187	4401	12.7%	24740	27201	2462	10.0%	13.44

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Joplin, MO	35669	41056	5387	15.1%	24897	27848	2950	11.9%	13.24
Kalamazoo-Portage, MI	36877	39608	2731	7.4%	29500	31227	1727	5.9%	13.90
Kansas City, MO-KS	42060	44700	2641	6.3%	33833	35514	1681	5.0%	14.00
Kennewick-Pasco-Richland, WA	40400	49166	8767	21.7%	34977	40896	5920	16.9%	12.71
Killeen-Temple-Fort Hood, TX	28186	32002	3816	13.5%	32170	35592	3422	10.6%	13.37
Knoxville, TN	39623	42641	3018	7.6%	28676	30402	1726	6.0%	13.88
Lafayette, IN	36857	40843	3986	10.8%	27488	29830	2342	8.5%	13.60
Lafayette, LA	63495	72838	9343	14.7%	31477	35113	3635	11.5%	13.27
Lakeland-Winter Haven, FL	28434	33444	5010	17.6%	26557	30220	3663	13.8%	13.03
Lancaster, PA	36615	42683	6068	16.6%	27199	30731	3532	13.0%	13.12
Lansing-East Lansing, MI	41302	43591	2290	5.5%	30364	31697	1333	4.4%	14.06
Las Cruces, NM	27374	32167	4792	17.5%	25607	29117	3510	13.7%	13.04
Las Vegas-Paradise, NV	40246	47075	6829	17.0%	31168	35310	4143	13.3%	13.08
Lexington-Fayette, KY	42693	44642	1949	4.6%	29365	30427	1062	3.6%	14.15
Lima, OH	39724	44646	4922	12.4%	27866	30581	2716	9.7%	13.47
Lincoln, NE	45241	47990	2749	6.1%	27695	29027	1332	4.8%	14.02
Little Rock-North Little Rock-Conway, AR	39438	43732	4294	10.9%	30815	33458	2643	8.6%	13.59
Longview, TX	43662	52293	8631	19.8%	26918	31076	4157	15.4%	12.86
Los Angeles-Long Beach-Santa Ana, CA	51959	59428	7469	14.4%	37661	41911	4251	11.3%	13.30
Louisville/Jefferson County, KY-IN	38410	41668	3258	8.5%	30451	32490	2039	6.7%	13.80
Lubbock, TX	38980	43957	4977	12.8%	24876	27373	2497	10.0%	13.43
Macon-Warner Robins, GA	40446	45221	4776	11.8%	28036	30642	2605	9.3%	13.51
Madison, WI	53057	53916	859	1.6%	31390	31794	404	1.3%	14.42
Mansfield, OH	32631	37581	4950	15.2%	26251	29375	3124	11.9%	13.23
McAllen-Edinburg-Mission, TX	21044	27010	5967	28.4%	19998	24395	4397	22.0%	12.20
Medford, OR	29961	33694	3733	12.5%	23097	25361	2263	9.8%	13.46
Memphis, TN-MS-AR	40318	43985	3667	9.1%	31947	34240	2293	7.2%	13.75
Merced, CA	25334	32584	7250	28.6%	25266	30871	5605	22.2%	12.18
Miami-Fort Lauderdale-Pompano Beach, FL	38326	42276	3950	10.3%	31244	33782	2538	8.1%	13.64
Milwaukee-Waukesha-West Allis, WI	43677	46680	3002	6.9%	35500	37430	1930	5.4%	13.94
Minneapolis-St. Paul-Bloomington, MN-WI	49744	51388	1644	3.3%	37770	38760	991	2.6%	14.27
Mobile, AL	36485	41267	4782	13.1%	29100	32098	2998	10.3%	13.40

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Modesto, CA	31278	37370	6092	19.5%	28839	33229	4390	15.2%	12.88
Monroe, LA	35360	40361	5000	14.1%	24389	27098	2708	11.1%	13.32
Montgomery, AL	35280	37849	2569	7.3%	28170	29791	1621	5.8%	13.91
Muncie, IN	29893	32431	2538	8.5%	24655	26308	1653	6.7%	13.80
Nashville-Davidson-Murfreesboro-Franklin, TN	41088	44370	3282	8.0%	31445	33430	1984	6.3%	13.85
New Haven-Milford, CT	49350	51552	2202	4.5%	34228	35439	1210	3.5%	14.16
New Orleans-Metairie-Kenner, LA	47013	51990	4977	10.6%	32612	35332	2720	8.3%	13.62
New York-Northern New Jersey-Long Island, NY-NJ-PA	55943	59159	3216	5.7%	46245	48350	2105	4.6%	14.05
Niles-Benton Harbor, MI	34002	37881	3878	11.4%	27206	29649	2443	9.0%	13.55
North Port-Bradenton-Sarasota, FL	30706	34671	3965	12.9%	24182	26638	2455	10.2%	13.42
Ocala, FL	23998	27909	3911	16.3%	22952	25884	2932	12.8%	13.14
Odessa, TX	54634	66746	12112	22.2%	33382	39151	5770	17.3%	12.67
Oklahoma City, OK	38986	43320	4333	11.1%	29496	32078	2582	8.8%	13.57
Olympia, WA	33352	35058	1706	5.1%	29859	31069	1210	4.1%	14.10
Omaha-Council Bluffs, NE-IA	44076	46481	2406	5.5%	31846	33222	1376	4.3%	14.07
Orlando-Kissimmee-Sanford, FL	44187	48463	4276	9.7%	31090	33462	2372	7.6%	13.70
Oxnard-Thousand Oaks-Ventura, CA	43179	49601	6422	14.9%	34522	38552	4030	11.7%	13.26
Palm Bay-Melbourne-Titusville, FL	33233	36389	3155	9.5%	33281	35773	2492	7.5%	13.71
Pensacola-Ferry Pass-Brent, FL	31451	34523	3072	9.8%	28051	30211	2160	7.7%	13.69
Peoria, IL	48439	52200	3761	7.8%	33957	36040	2083	6.1%	13.87
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	47277	49825	2547	5.4%	38729	40382	1653	4.3%	14.08
Phoenix-Mesa-Glendale, AZ	39295	43648	4354	11.1%	33072	35958	2886	8.7%	13.58
Pittsburgh, PA	44129	46598	2470	5.6%	33375	34854	1479	4.4%	14.06
Port St. Lucie, FL	24588	28351	3763	15.3%	24058	26947	2888	12.0%	13.22
Portland-Vancouver-Hillsboro, OR-WA	51268	54674	3407	6.6%	36395	38307	1913	5.3%	13.96
Providence-New Bedford-Fall River, RI-MA	39458	43808	4350	11.0%	32146	34938	2791	8.7%	13.58
Provo-Orem, UT	25829	28044	2215	8.6%	23371	24953	1582	6.8%	13.79
Racine, WI	29416	33251	3834	13.0%	31283	34488	3206	10.2%	13.41
Raleigh-Cary-Durham-Chapel Hill, NC	48140	49469	1328	2.8%	36332	37128	796	2.2%	14.32
Reading, PA	34243	39591	5349	15.6%	28696	32211	3515	12.2%	13.20
Redding, CA	32891	35867	2976	9.0%	24590	26346	1756	7.1%	13.75

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Reno-Sparks, NV	44267	49371	5103	11.5%	29629	32318	2689	9.1%	13.54
Richmond, VA	47865	51298	3433	7.2%	34726	36695	1969	5.7%	13.92
Riverside-San Bernardino-Ontario, CA	27826	33394	5568	20.0%	27550	31857	4306	15.6%	12.84
Roanoke, VA	47439	51581	4141	8.7%	29888	31947	2059	6.9%	13.78
Rochester, MN	44046	45652	1607	3.6%	37685	38776	1090	2.9%	14.24
Rochester, NY	49891	52490	2599	5.2%	30898	32173	1275	4.1%	14.09
Rockford, IL	38329	42919	4590	12.0%	29207	31959	2753	9.4%	13.50
Sacramento-Arden-Arcade-Roseville, CA	42507	46177	3670	8.6%	35372	37783	2411	6.8%	13.79
Saginaw-Bay City-Midland, MI	32842	35829	2986	9.1%	28206	30230	2024	7.2%	13.75
Salem, OR	30216	34801	4585	15.2%	26653	29826	3173	11.9%	13.23
Salinas, CA	36982	48654	11672	31.6%	30942	38495	7553	24.4%	11.97
Salt Lake City-Ogden-Clearfield, UT	42940	46978	4039	9.4%	30177	32416	2239	7.4%	13.72
San Antonio-New Braunfels, TX	35727	40584	4857	13.6%	28962	32056	3094	10.7%	13.36
San Diego-Carlsbad-San Marcos, CA	50613	54861	4248	8.4%	36914	39361	2446	6.6%	13.81
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	56494	58804	2311	4.1%	45241	46708	1467	3.2%	14.20
San Jose-Sunnyvale-Santa Clara, CA	68609	68862	253	0.4%	69789	69994	205	0.3%	14.54
Santa Barbara-Santa Maria-Goleta, CA	46286	54239	7953	17.2%	31429	35658	4229	13.5%	13.07
Santa Cruz-Watsonville, CA	36030	42183	6153	17.1%	26863	30456	3593	13.4%	13.08
Santa Fe, NM	31118	32731	1614	5.2%	26984	28092	1108	4.1%	14.10
Santa Rosa-Petaluma, CA	41283	45878	4594	11.1%	28974	31513	2539	8.8%	13.57
Savannah, GA	35708	39681	3973	11.1%	29168	31724	2556	8.8%	13.57
Scranton-Wilkes-Barre, PA	37700	42082	4382	11.6%	26797	29249	2452	9.2%	13.53
Seattle-Tacoma-Bellevue, WA	55494	57912	2418	4.4%	41373	42802	1429	3.5%	14.17
Shreveport-Bossier City, LA	44874	51340	6466	14.4%	28380	31591	3211	11.3%	13.30
South Bend-Mishawaka, IN-MI	32929	35902	2973	9.0%	28357	30377	2020	7.1%	13.75
Spokane, WA	41639	44569	2931	7.0%	28777	30378	1601	5.6%	13.93
Springfield, IL	48800	50968	2168	4.4%	32791	33945	1155	3.5%	14.16
Springfield, MA	37832	40619	2787	7.4%	29144	30841	1697	5.8%	13.90
Springfield, MO	33945	37048	3104	9.1%	23997	25728	1731	7.2%	13.74
St. Cloud, MN	43428	49052	5624	13.0%	26003	28651	2648	10.2%	13.42
St. Louis, MO-IL	39444	41930	2485	6.3%	33976	35670	1694	5.0%	14.00
State College, PA	40453	41472	1019	2.5%	24299	24785	486	2.0%	14.34

Table F-5a: Hypothetical returns if metros had the same years of schooling in 2010 as Washington-Arlington-Alexandria, DC-VA-MD-WV (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010
Stockton, CA	30048	36359	6311	21.0%	29190	33975	4785	16.4%	12.76
Syracuse, NY	50307	53998	3691	7.3%	31271	33085	1814	5.8%	13.90
Tampa-St. Petersburg-Clearwater, FL	38014	41951	3938	10.4%	31801	34398	2596	8.2%	13.64
Terre Haute, IN	33380	36804	3424	10.3%	25868	27959	2091	8.1%	13.65
Toledo, OH	37810	41340	3529	9.3%	29573	31751	2178	7.4%	13.73
Trenton-Ewing, NJ	67133	68010	877	1.3%	45787	46262	475	1.0%	14.45
Tucson, AZ	32976	35694	2718	8.2%	28295	30137	1842	6.5%	13.82
Tulsa, OK	37926	42484	4558	12.0%	29034	31779	2746	9.5%	13.50
Tuscaloosa, AL	36909	41059	4151	11.2%	28481	31003	2522	8.9%	13.56
Tyler, TX	40674	47473	6799	16.7%	26749	30252	3503	13.1%	13.11
Utica-Rome, NY	41654	45865	4211	10.1%	26762	28894	2133	8.0%	13.66
Vineland-Millville-Bridgeton, NJ	36599	43756	7158	19.6%	31604	36434	4830	15.3%	12.88
Virginia Beach-Norfolk-Newport News, VA-NC	46014	50226	4213	9.2%	33249	35651	2402	7.2%	13.74
Visalia-Porterville, CA	29060	38710	9650	33.2%	24305	30538	6233	25.6%	11.85
Waco, TX	41583	48385	6802	16.4%	27232	30724	3491	12.8%	13.13
Washington-Arlington-Alexandria, DC-VA-MD-WV	62666	62666	0	0.0%	48572	48572	0	0.0%	14.58
Waterloo-Cedar Falls, IA	42682	46836	4154	9.7%	27217	29305	2089	7.7%	13.69
Wausau, WI	41803	47627	5824	13.9%	27488	30496	3008	10.9%	13.34
Wichita Falls, TX	35780	41045	5265	14.7%	23877	26635	2758	11.6%	13.27
Wichita, KS	37070	40916	3847	10.4%	29827	32266	2439	8.2%	13.64
Williamsport, PA	36833	42953	6119	16.6%	25622	28957	3335	13.0%	13.11
Wilmington, NC	36092	38615	2524	7.0%	25568	26981	1414	5.5%	13.93
Worcester, MA	36962	38363	1401	3.8%	33251	34250	1000	3.0%	14.22
Yakima, WA	30656	40543	9888	32.3%	25149	31418	6269	24.9%	11.92
York-Hanover, PA	34201	38991	4790	14.0%	29375	32607	3232	11.0%	13.33
Youngstown-Warren-Boardman, OH-PA	30942	34810	3867	12.5%	25699	28225	2526	9.8%	13.46
Yuba City, CA	25860	31233	5373	20.8%	25320	29427	4107	16.2%	12.78
Yuma, AZ	24958	30365	5407	21.7%	25722	30069	4346	16.9%	12.71

Data sources: Authors' calculation based on results of regression (3)s in F-1a and table F-1b; data are from the U.S. Bureau of Economic Analysis, Moody's Analytics, Science-Metrix, and IPUMS (Integrated Public Use Microdata Series) data based on census 1990 and 2000, and the American Community Survey one-year estimates for 2010.

Notes:
* Hypothetical values for each metropolitan area are values of real GDP per capita and real wages per worker if the average workforce in that metro maintained the same years of education as in 1990, holding other factors constant. This permits an estimate of the rise in real GDP per capita and real wages per worker attributable to the actual increase in average years of schooling between 1990 and 2010 for each metro. The hypothetical values are calculated based on our estimation that, on average, one extra year of schooling is associated with an approximately 10.5 percent increase in real GDP per capita and an 8.4 percent increase in real wages per worker.

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Abilene, TX	35217	33966	1251	3.7%	23224	22565	659	2.9%	13.41	13.06
Akron, OH	36237	33984	2253	6.6%	30383	28869	1514	5.2%	13.87	13.26
Albany-Schenectady-Troy, NY	52363	49405	2959	6.0%	33682	32158	1524	4.7%	14.23	13.68
Albuquerque, NM	37823	37304	518	1.4%	30947	30609	338	1.1%	13.73	13.60
Alexandria, LA	34600	33574	1026	3.1%	26318	25695	623	2.4%	13.13	12.84
Allentown-Bethlehem-Easton, PA-NJ	34265	32129	2137	6.7%	31214	29654	1560	5.3%	13.74	13.12
Altoona, PA	37809	35779	2031	5.7%	26215	25088	1127	4.5%	13.29	12.76
Amarillo, TX	40179	39817	362	0.9%	26095	25907	187	0.7%	13.13	13.04
Anchorage, AK	54356	52408	1948	3.7%	37349	36280	1070	2.9%	14.05	13.70
Ann Arbor, MI	48159	46263	1896	4.1%	33780	32717	1063	3.2%	14.55	14.16
Anniston-Oxford, AL	34376	32765	1611	4.9%	27354	26328	1026	3.9%	13.23	12.77
Appleton-Oshkosh-Neenah, WI	41222	39227	1995	5.1%	30726	29536	1190	4.0%	13.53	13.06
Asheville, NC	34282	31341	2940	9.4%	23734	22098	1636	7.4%	13.82	12.97
Atlanta-Sandy Springs-Marietta, GA	42760	41037	1724	4.2%	35021	33892	1129	3.3%	13.95	13.56
Atlantic City-Hammonton, NJ	45183	43245	1938	4.5%	30541	29493	1048	3.6%	13.33	12.91
Augusta-Richmond County, GA-SC	31476	28628	2848	9.9%	28190	26140	2050	7.8%	13.76	12.86
Austin-Round Rock-San Marcos, TX	43812	42682	1130	2.6%	34110	33408	702	2.1%	13.92	13.67
Bakersfield-Delano, CA	40494	41273	-778	-1.9%	32304	32798	-493	-1.5%	12.33	12.51
Baltimore-Towson, MD	47737	44428	3309	7.4%	38079	35962	2117	5.9%	14.07	13.39
Baton Rouge, LA	42511	41361	1151	2.8%	29715	29073	642	2.2%	13.66	13.40
Beaumont-Port Arthur, TX	49004	49352	-347	-0.7%	31172	31348	-176	-0.6%	12.82	12.89
Bellingham, WA	40511	37617	2894	7.7%	26338	24828	1509	6.1%	14.09	13.38
Billings, MT	38685	37088	1598	4.3%	26804	25919	885	3.4%	13.79	13.39
Binghamton, NY	44647	43561	1086	2.5%	29505	28932	573	2.0%	13.69	13.46
Birmingham-Hoover, AL	37212	34834	2378	6.8%	30903	29320	1583	5.4%	13.91	13.28
Bloomington, IN	35836	34196	1640	4.8%	23850	22977	873	3.8%	14.20	13.76
Bloomington-Normal, IL	56339	53686	2653	4.9%	35743	34397	1347	3.9%	14.10	13.64
Boise-Nampa, ID	35266	34193	1072	3.1%	27508	26840	668	2.5%	13.86	13.57
Boston-Cambridge-Quincy, MA-NH	58892	55322	3570	6.5%	45104	42913	2191	5.1%	14.54	13.94
Bremerton-Silverdale, WA	35536	34446	1090	3.2%	31896	31115	781	2.5%	13.73	13.43
Bridgeport-Stamford-Norwalk, CT	63726	59012	4714	8.0%	50285	47300	2985	6.3%	14.34	13.61
Brownsville-Harlingen, TX	24619	22508	2111	9.4%	20397	18992	1405	7.4%	12.13	11.28
Buffalo-Niagara Falls, NY	50264	47220	3044	6.4%	30453	28975	1477	5.1%	14.01	13.41

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Canton-Massillon, OH	30744	28872	1872	6.5%	24910	23695	1216	5.1%	13.49	12.89
Cape Coral-Fort Myers, FL	29211	28074	1137	4.0%	25715	24915	800	3.2%	13.23	12.85
Cedar Rapids, IA	48666	46144	2523	5.5%	31851	30529	1322	4.3%	13.96	13.45
Champaign-Urbana, IL	45445	43797	1648	3.8%	27917	27108	809	3.0%	14.38	14.03
Charleston-North Charleston-Summerville, SC	34364	31260	3104	9.9%	28350	26292	2058	7.8%	13.94	13.04
Charlotte-Gastonia-Rock Hill, NC-SC	47259	43566	3693	8.5%	35952	33697	2255	6.7%	13.77	12.99
Chattanooga, TN-GA	39356	36871	2485	6.7%	28200	26773	1427	5.3%	13.45	12.83
Chicago-Joliet-Naperville, IL-IN-WI	46944	43898	3046	6.9%	38615	36606	2008	5.5%	14.00	13.37
Chico, CA	36342	36323	19	0.1%	23587	23577	10	0.0%	13.54	13.53
Cincinnati-Middletown, OH-KY-IN	39750	36937	2813	7.6%	33478	31577	1900	6.0%	13.95	13.25
Clarksville, TN-KY	26095	24465	1630	6.7%	30622	29089	1533	5.3%	13.60	12.98
Cleveland-Elyria-Mentor, OH	42174	39888	2285	5.7%	33160	31722	1439	4.5%	13.85	13.32
College Station-Bryan, TX	35298	34532	766	2.2%	24609	24183	426	1.8%	13.97	13.77
Colorado Springs, CO	37422	36448	973	2.7%	32322	31651	671	2.1%	13.96	13.71
Columbia, MO	38433	35421	3012	8.5%	26071	24431	1640	6.7%	14.66	13.89
Columbia, SC	36830	34440	2390	6.9%	28379	26902	1477	5.5%	14.06	13.42
Columbus, OH	43195	40377	2818	7.0%	32868	31149	1719	5.5%	14.02	13.38
Corpus Christi, TX	42350	42103	247	0.6%	28035	27905	131	0.5%	12.77	12.71
Dallas-Fort Worth-Arlington, TX	46598	45459	1140	2.5%	35752	35054	698	2.0%	13.47	13.23
Danville, VA	31546	28106	3440	12.2%	23753	21667	2086	9.6%	13.18	12.08
Davenport-Moline-Rock Island, IA-IL	42950	40805	2145	5.3%	31688	30422	1267	4.2%	13.72	13.23
Dayton-Springfield, OH	35223	33807	1417	4.2%	30822	29831	991	3.3%	13.76	13.37
Decatur, AL	28636	27896	740	2.7%	25190	24670	520	2.1%	12.73	12.48
Decatur, IL	48836	45723	3113	6.8%	32135	30493	1642	5.4%	13.57	12.95
Deltona-Daytona Beach-Ormond Beach, FL	26638	25285	1353	5.4%	25685	24641	1044	4.2%	13.39	12.90
Des Moines-West Des Moines, IA	55447	53164	2283	4.3%	33762	32650	1112	3.4%	13.87	13.47
Detroit-Warren-Livonia, MI	37766	35381	2384	6.7%	35443	33650	1793	5.3%	13.98	13.36
Duluth, MN-WI	34659	32441	2218	6.8%	26901	25522	1380	5.4%	14.01	13.38
Eau Claire, WI	38627	37296	1332	3.6%	25231	24536	695	2.8%	13.50	13.16
El Paso, TX	29774	28022	1751	6.2%	25245	24056	1190	4.9%	12.85	12.27
Elkhart-Goshen, IN	48212	46611	1601	3.4%	28744	27981	762	2.7%	12.67	12.34
Erie, PA	37735	35833	1901	5.3%	26628	25554	1074	4.2%	13.57	13.08

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Eugene-Springfield, OR	32771	31789	982	3.1%	25297	24691	606	2.5%	13.87	13.58
Fayetteville, NC	34842	33252	1590	4.8%	34381	33126	1255	3.8%	13.51	13.07
Fayetteville-Springdale-Rogers, AR-MO	33960	32693	1267	3.9%	30373	29468	906	3.1%	13.26	12.89
Flint, MI	26319	24132	2188	9.1%	26225	24475	1751	7.2%	13.99	13.16
Florence-Muscle Shoals, AL	27863	25984	1879	7.2%	23355	22092	1263	5.7%	13.32	12.65
Fort Collins-Loveland, CO	40369	36818	3551	9.6%	27187	25265	1922	7.6%	14.78	13.90
Fort Wayne, IN	40992	39589	1403	3.5%	29963	29143	820	2.8%	13.46	13.13
Fresno, CA	36459	35140	1320	3.8%	27755	26952	803	3.0%	12.80	12.44
Gainesville, FL	40556	39555	1001	2.5%	28720	28155	566	2.0%	14.27	14.03
Grand Rapids-Wyoming, MI	41097	38810	2287	5.9%	29485	28171	1314	4.7%	13.68	13.14
Greeley, CO	31161	30319	842	2.8%	26044	25483	562	2.2%	13.29	13.03
Greensboro-Winston-Salem-High Point, NC	44041	41389	2652	6.4%	30003	28556	1448	5.1%	13.51	12.92
Greenville-Mauldin-Easley-Spartanburg-Anderson, SC	33199	30662	2537	8.3%	27637	25942	1695	6.5%	13.45	12.69
Gulfport-Biloxi, MS	34812	33915	896	2.6%	28456	27871	585	2.1%	13.39	13.14
Hagerstown-Martinsburg, MD-WV	30385	28441	1944	6.8%	27848	26420	1428	5.4%	13.31	12.68
Harrisburg-Lebanon-Carlisle, PA	46960	43857	3103	7.1%	32392	30676	1716	5.6%	13.70	13.05
Hartford-West Hartford-East Hartford, CT	71175	67223	3952	5.9%	40297	38506	1792	4.7%	14.22	13.68
Hickory-Lenoir-Morganton, NC	32197	29772	2425	8.1%	23632	22204	1428	6.4%	13.03	12.29
Honolulu, HI	46923	44659	2264	5.1%	33235	31952	1283	4.0%	13.92	13.45
Houma-Bayou Cane-Thibodaux, LA	50280	47363	2917	6.2%	34121	32536	1586	4.9%	12.55	11.98
Houston-Sugar Land-Baytown, TX	53050	52027	1023	2.0%	39861	39248	613	1.6%	13.25	13.07
Indianapolis-Carmel, IN	46453	43726	2727	6.2%	32898	31351	1547	4.9%	13.81	13.23
Jackson, MI	29538	28214	1324	4.7%	27419	26436	983	3.7%	13.55	13.12
Jackson, MS	37838	36859	979	2.7%	27205	26643	562	2.1%	13.92	13.67
Jacksonville, FL	39954	37706	2247	6.0%	32070	30626	1445	4.7%	13.69	13.14
Jacksonville, NC	28391	27424	967	3.5%	33538	32625	912	2.8%	13.13	12.80
Janesville, WI	27747	26845	903	3.4%	27544	26828	716	2.7%	13.27	12.95
Johnson City-Kingsport-Bristol, TN-VA	33190	30581	2609	8.5%	26032	24390	1643	6.7%	13.50	12.72
Johnstown, PA	34785	32697	2088	6.4%	24740	23550	1190	5.1%	13.44	12.85
Joplin, MO	35669	33715	1954	5.8%	24897	23805	1092	4.6%	13.24	12.70
Kalamazoo-Portage, MI	36877	35887	990	2.8%	29500	28868	632	2.2%	13.90	13.64
Kansas City, MO-KS	42060	39832	2228	5.6%	33833	32399	1435	4.4%	14.00	13.48
Kennewick-Pasco-Richland, WA	40400	41899	-1500	-3.6%	34977	36007	-1030	-2.9%	12.71	13.05
Killeen-Temple-Fort Hood, TX	28186	27202	984	3.6%	32170	31272	898	2.9%	13.37	13.03

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Knoxville, TN	39623	35975	3648	10.1%	28676	26554	2122	8.0%	13.88	12.96
Lafayette, IN	36857	37037	-180	-0.5%	27488	27595	-107	-0.4%	13.60	13.65
Lafayette, LA	63495	61545	1950	3.2%	31477	30705	772	2.5%	13.27	12.97
Lakeland-Winter Haven, FL	28434	27112	1322	4.9%	26557	25569	988	3.9%	13.03	12.58
Lancaster, PA	36615	33643	2972	8.8%	27199	25426	1773	7.0%	13.12	12.31
Lansing-East Lansing, MI	41302	39710	1592	4.0%	30364	29429	935	3.2%	14.06	13.69
Las Cruces, NM	27374	27188	186	0.7%	25607	25468	139	0.5%	13.04	12.98
Las Vegas-Paradise, NV	40246	39094	1152	2.9%	31168	30456	712	2.3%	13.08	12.81
Lexington-Fayette, KY	42693	39798	2895	7.3%	29365	27768	1597	5.8%	14.15	13.48
Lima, OH	39724	36911	2813	7.6%	27866	26283	1583	6.0%	13.47	12.77
Lincoln, NE	45241	43971	1270	2.9%	27695	27075	621	2.3%	14.02	13.74
Little Rock-North Little Rock-Conway, AR	39438	38374	1064	2.8%	30815	30152	664	2.2%	13.59	13.33
Longview, TX	43662	44031	-369	-0.8%	26918	27099	-181	-0.7%	12.86	12.94
Los Angeles-Long Beach-Santa Ana, CA	51959	49714	2244	4.5%	37661	36360	1301	3.6%	13.30	12.88
Louisville/Jefferson County, KY-IN	38410	35774	2636	7.4%	30451	28775	1676	5.8%	13.80	13.13
Lubbock, TX	38980	37829	1151	3.0%	24876	24289	587	2.4%	13.43	13.15
Macon-Warner Robins, GA	40446	37463	2982	8.0%	28036	26378	1659	6.3%	13.51	12.79
Madison, WI	53057	50861	2196	4.3%	31390	30352	1039	3.4%	14.42	14.02
Mansfield, OH	32631	30861	1770	5.7%	26251	25111	1140	4.5%	13.23	12.70
McAllen-Edinburg-Mission, TX	21044	18704	2339	12.5%	19998	18207	1791	9.8%	12.20	11.08
Medford, OR	29961	29085	876	3.0%	23097	22558	539	2.4%	13.46	13.18
Memphis, TN-MS-AR	40318	38103	2215	5.8%	31947	30542	1405	4.6%	13.75	13.21
Merced, CA	25334	25580	-245	-1.0%	25266	25460	-195	-0.8%	12.18	12.27
Miami-Fort Lauderdale-Pompano Beach, FL	38326	35456	2870	8.1%	31244	29367	1877	6.4%	13.64	12.90
Milwaukee-Waukesha-West Allis, WI	43677	41113	2564	6.2%	35500	33831	1669	4.9%	13.94	13.37
Minneapolis-St. Paul-Bloomington, MN-WI	49744	47087	2658	5.6%	37770	36154	1616	4.5%	14.27	13.75
Mobile, AL	36485	34995	1490	4.3%	29100	28150	950	3.4%	13.40	13.01
Modesto, CA	31278	30416	862	2.8%	28839	28205	635	2.3%	12.88	12.62
Monroe, LA	35360	34615	745	2.2%	24389	23979	410	1.7%	13.32	13.12
Montgomery, AL	35280	33199	2081	6.3%	28170	26839	1331	5.0%	13.91	13.33
Muncie, IN	29893	27802	2091	7.5%	24655	23272	1383	5.9%	13.80	13.11
Nashville-Davidson-Murfreesboro-Franklin, TN	41088	38155	2932	7.7%	31445	29645	1800	6.1%	13.85	13.14
New Haven-Milford, CT	49350	47478	1873	3.9%	34228	33190	1038	3.1%	14.16	13.79

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
New Orleans-Metairie-Kenner, LA	47013	45474	1538	3.4%	32612	31759	853	2.7%	13.62	13.30
New York-Northern New Jersey-Long Island, NY-NJ-PA	55943	52816	3127	5.9%	46245	44175	2070	4.7%	14.05	13.50
Niles-Benton Harbor, MI	34002	32251	1752	5.4%	27206	26084	1122	4.3%	13.55	13.05
North Port-Bradenton-Sarasota, FL	30706	29086	1620	5.6%	24182	23161	1021	4.4%	13.42	12.90
Ocala, FL	23998	22973	1024	4.5%	22952	22169	784	3.5%	13.14	12.72
Odessa, TX	54634	52894	1741	3.3%	33382	32532	850	2.6%	12.67	12.36
Oklahoma City, OK	38986	38248	739	1.9%	29496	29050	446	1.5%	13.57	13.39
Olympia, WA	33352	32273	1080	3.3%	29859	29087	772	2.7%	14.10	13.79
Omaha-Council Bluffs, NE-IA	44076	41601	2475	5.9%	31846	30414	1432	4.7%	14.07	13.52
Orlando-Kissimmee-Sanford, FL	44187	41960	2227	5.3%	31090	29836	1254	4.2%	13.70	13.21
Oxnard-Thousand Oaks-Ventura, CA	43179	41327	1852	4.5%	34522	33338	1184	3.6%	13.26	12.84
Palm Bay-Melbourne-Titusville, FL	33233	32248	985	3.1%	33281	32493	788	2.4%	13.71	13.43
Pensacola-Ferry Pass-Brent, FL	31451	29995	1457	4.9%	28051	27012	1039	3.8%	13.69	13.24
Peoria, IL	48439	45442	2996	6.6%	33957	32273	1683	5.2%	13.87	13.26
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	47277	44160	3117	7.1%	38729	36682	2047	5.6%	14.08	13.43
Phoenix-Mesa-Glendale, AZ	39295	38098	1196	3.1%	33072	32268	804	2.5%	13.58	13.28
Pittsburgh, PA	44129	41880	2249	5.4%	33375	32014	1362	4.3%	14.06	13.56
Port St. Lucie, FL	24588	23409	1179	5.0%	24058	23135	923	4.0%	13.22	12.75
Portland-Vancouver-Hillsboro, OR-WA	51268	49284	1983	4.0%	36395	35269	1125	3.2%	13.96	13.59
Providence-New Bedford-Fall River, RI-MA	39458	36140	3319	9.2%	32146	29975	2172	7.2%	13.58	12.74
Provo-Orem, UT	25829	25393	436	1.7%	23371	23056	315	1.4%	13.79	13.63
Racine, WI	29416	28204	1212	4.3%	31283	30252	1031	3.4%	13.41	13.01
Raleigh-Cary-Durham-Chapel Hill, NC	48140	45694	2446	5.4%	36332	34854	1478	4.2%	14.32	13.82
Reading, PA	34243	32249	1993	6.2%	28696	27357	1338	4.9%	13.20	12.62
Redding, CA	32891	31244	1647	5.3%	24590	23605	986	4.2%	13.75	13.26
Reno-Sparks, NV	44267	42978	1290	3.0%	29629	28940	689	2.4%	13.54	13.26
Richmond, VA	47865	45128	2737	6.1%	34726	33135	1590	4.8%	13.92	13.36
Riverside-San Bernardino-Ontario, CA	27826	27356	470	1.7%	27550	27179	371	1.4%	12.84	12.68
Roanoke, VA	47439	43586	3854	8.8%	29888	27938	1950	7.0%	13.78	12.97
Rochester, MN	44046	41530	2516	6.1%	37685	35961	1724	4.8%	14.24	13.68
Rochester, NY	49891	47061	2830	6.0%	30898	29494	1404	4.8%	14.09	13.54
Rockford, IL	38329	36169	2160	6.0%	29207	27889	1318	4.7%	13.50	12.95
Sacramento-Arden-Arcade-Roseville, CA	42507	41933	574	1.4%	35372	34992	381	1.1%	13.79	13.66

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Saginaw-Bay City-Midland, MI	32842	30758	2085	6.8%	28206	26771	1435	5.4%	13.75	13.12
Salem, OR	30216	30070	146	0.5%	26653	26550	103	0.4%	13.23	13.19
Salinas, CA	36982	39970	-2989	-7.5%	30942	32918	-1975	-6.0%	11.97	12.71
Salt Lake City-Ogden-Clearfield, UT	42940	42281	658	1.6%	30177	29808	369	1.2%	13.72	13.57
San Antonio-New Braunfels, TX	35727	34434	1293	3.8%	28962	28125	837	3.0%	13.36	13.01
San Diego-Carlsbad-San Marcos, CA	50613	48538	2075	4.3%	36914	35704	1210	3.4%	13.81	13.41
San Francisco-Oakland-Fremont-Vallejo-Fairfield-Napa, CA	56494	54371	2122	3.9%	45241	43883	1358	3.1%	14.20	13.83
San Jose-Sunnyvale-Santa Clara, CA	68609	64052	4557	7.1%	69789	66073	3716	5.6%	14.54	13.89
Santa Barbara-Santa Maria-Goleta, CA	46286	47249	-963	-2.0%	31429	31949	-519	-1.6%	13.07	13.26
Santa Cruz-Watsonville, CA	36030	36329	-299	-0.8%	26863	27040	-177	-0.7%	13.08	13.15
Santa Fe, NM	31118	30508	610	2.0%	26984	26562	422	1.6%	14.10	13.91
Santa Rosa-Petaluma, CA	41283	40860	423	1.0%	28974	28737	237	0.8%	13.57	13.47
Savannah, GA	35708	33409	2298	6.9%	29168	27663	1505	5.4%	13.57	12.94
Scranton-Wilkes-Barre, PA	37700	35659	2041	5.7%	26797	25635	1162	4.5%	13.53	13.00
Seattle-Tacoma-Bellevue, WA	55494	53208	2286	4.3%	41373	40010	1363	3.4%	14.17	13.77
Shreveport-Bossier City, LA	44874	44356	518	1.2%	28380	28119	261	0.9%	13.30	13.18
South Bend-Mishawaka, IN-MI	32929	31008	1921	6.2%	28357	27032	1325	4.9%	13.75	13.18
Spokane, WA	41639	40161	1478	3.7%	28777	27961	816	2.9%	13.93	13.59
Springfield, IL	48800	45472	3328	7.3%	32791	30998	1793	5.8%	14.16	13.49
Springfield, MA	37832	34888	2944	8.4%	29144	27323	1821	6.7%	13.90	13.13
Springfield, MO	33945	32110	1834	5.7%	23997	22958	1038	4.5%	13.74	13.22
St. Cloud, MN	43428	41867	1561	3.7%	26003	25256	747	3.0%	13.42	13.07
St. Louis, MO-IL	39444	36942	2502	6.8%	33976	32249	1727	5.4%	14.00	13.37
State College, PA	40453	38120	2333	6.1%	24299	23176	1123	4.8%	14.34	13.77
Stockton, CA	30048	29575	474	1.6%	29190	28823	367	1.3%	12.76	12.61
Syracuse, NY	50307	48078	2229	4.6%	31271	30163	1108	3.7%	13.90	13.47
Tampa-St. Petersburg-Clearwater, FL	38014	35923	2091	5.8%	31801	30401	1401	4.6%	13.64	13.10
Terre Haute, IN	33380	31868	1512	4.7%	25868	24930	937	3.8%	13.65	13.21
Toledo, OH	37810	36180	1630	4.5%	29573	28553	1020	3.6%	13.73	13.31
Trenton-Ewing, NJ	67133	63002	4131	6.6%	45787	43529	2258	5.2%	14.45	13.85
Tucson, AZ	32976	31796	1180	3.7%	28295	27486	809	2.9%	13.82	13.48
Tulsa, OK	37926	37310	616	1.7%	29034	28657	376	1.3%	13.50	13.34
Tuscaloosa, AL	36909	35442	1466	4.1%	28481	27576	905	3.3%	13.56	13.18

Table F-5b: Hypothetical economic returns attributable to each metro's rise in average years of schooling between 1990 and 2010 (continued)

	Real GDP per capita (US$)				Real wages per worker (US$)				Average years of schooling	
	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	Actual value	Hypothetical value*	Increase (level)	Increase (percent)	2010	1990
Tyler, TX	40674	40885	-211	-0.5%	26749	26859	-110	-0.4%	13.11	13.15
Utica-Rome, NY	41654	40130	1524	3.8%	26762	25979	783	3.0%	13.66	13.31
Vineland-Millville-Bridgeton, NJ	36599	34636	1962	5.7%	31604	30247	1357	4.5%	12.88	12.35
Virginia Beach-Norfolk-Newport News, VA-NC	46014	43463	2550	5.9%	33249	31773	1476	4.6%	13.74	13.20
Visalia-Porterville, CA	29060	29095	-35	-0.1%	24305	24328	-23	-0.1%	11.85	11.86
Waco, TX	41583	40355	1228	3.0%	27232	26590	642	2.4%	13.13	12.85
Washington-Arlington-Alexandria, DC-VA-MD-WV	62666	59815	2850	4.8%	48572	46804	1767	3.8%	14.58	14.13
Waterloo-Cedar Falls, IA	42682	40337	2345	5.8%	27217	26019	1197	4.6%	13.69	13.15
Wausau, WI	41803	39230	2572	6.6%	27488	26132	1355	5.2%	13.34	12.73
Wichita Falls, TX	35780	34615	1165	3.4%	23877	23256	621	2.7%	13.27	12.95
Wichita, KS	37070	35973	1096	3.0%	29827	29122	704	2.4%	13.64	13.35
Williamsport, PA	36833	35399	1434	4.1%	25622	24824	798	3.2%	13.11	12.74
Wilmington, NC	36092	32884	3208	9.8%	25568	23742	1826	7.7%	13.93	13.05
Worcester, MA	36962	34251	2711	7.9%	33251	31294	1957	6.3%	14.22	13.50
Yakima, WA	30656	31510	-854	-2.7%	25149	25705	-556	-2.2%	11.92	12.18
York-Hanover, PA	34201	31404	2797	8.9%	29375	27446	1929	7.0%	13.33	12.52
Youngstown-Warren-Boardman, OH-PA	30942	29334	1608	5.5%	25699	24630	1069	4.3%	13.46	12.95
Yuba City, CA	25860	26020	-160	-0.6%	25320	25445	-125	-0.5%	12.78	12.84
Yuma, AZ	24958	23812	1146	4.8%	25722	24777	945	3.8%	12.71	12.26

Data sources: Authors' calculation based on results of regression (3)s in F-1a and table F-1b; data are from the U.S. Bureau of Economic Analysis, Moody's Analytics, Science-Metrix, and IPUMS (Integrated Public Use Microdata Series) data based on census 1990 and 2000, and the American Community Survey one-year estimates for 2010.

Notes:

* Hypothetical values for each metropolitan area are values of real GDP per capita and real wage per worker if the average workforce in that metro maintained the same years of education as in 1990, holding other factors constant. This permits an estimate of the rise in real GDP per capita and real wages per worker attributable to the actual increase in average years of schooling between 1990 and 2010 for each metro. The hypothetical values are calculated based on our estimation that, on average, one extra year of schooling is associated with an approximately 10.5 percent increase in real GDP per capita and an 8.4 percent increase in real wage per worker.

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