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IN THIS ISSUE

Research has shown that the level of education requested in online job advertisements varies across metro areas, even for the same occupation.

In this paper, we focus on four middle-skills occupations and investigate whether the observed variation can be fully explained by the characteristics of the jobs themselves.

Even after controlling for the characteristics of the online job advertisements, we find that that employers' preferences for a bachelor's degree are higher where recent college graduates are relatively more numerous, where wages are higher, in larger metro areas, and in the Northeast.

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Uneven Opportunity: Exploring Employers' Educational Preferences for Middle-Skills Jobs

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INTRODUCTION

This analysis follows research published in 2015 by the Federal Reserve Banks of Philadelphia, Cleveland, and Atlanta on "opportunity occupations," which are defined as occupations that pay at least the national annual median wage, adjusted for differences in local consumption prices, and that are generally considered accessible to a worker without a four-year college degree (Wardrip et al., 2015). Among the primary findings in the original research is that, in online job advertisements, employers often express a preference for a college-educated candidate even for occupations that have not traditionally required one. Further, the authors find that even for the same occupation, employers' educational expectations can be much higher in some metropolitan (metro) areas than in others.

Focusing on four large opportunity occupations — computer user support specialists, registered nurses,[1] first-line supervisors of retail sales workers, and executive secretaries/executive administrative assistants[2] — this research seeks to explain the metro area variation in employers' preferences for college-educated workers. Using data from the online job advertisements themselves and from the metro areas in which they were posted, we develop a series of logistic regression models that predict the likelihood that each individual job ad will include a request for a bachelor's degree or higher.

Understanding the drivers of differences in employers' educational preferences across metro areas, which are functional representations of local labor markets, is an important area of research as it will help workers and workforce development practitioners better understand the credentials needed to gain access to opportunity occupations in certain types of labor markets. For many of these occupations, the level of skills and education that a worker needs to get a foot in the door are not cut and dried, and, as we show, local context matters.

SHIFTING PREFERENCES FOR COLLEGE-EDUCATED WORKERS

An abundance of recent research using real-time labor market information (RTLMI) indicates that employers' educational preferences for candidates to fill open positions vary across space and time. In addition to the research by Wardrip et al. (2015) on which this analysis builds, others have used RTLMI to illustrate the degree to which different metropolitan economies require different levels of education from their workers. For example, Rothwell (2012) shows that approximately 56 percent of all online job postings in the San Jose–Sunnyvale–Santa Clara, CA, metro area requested a bachelor's degree or higher compared with only 29 percent in the Cape Coral–Fort Myers, FL, metro area. Naturally, much of the difference in this example can be attributed to the types of occupations and industries that are prevalent in these two metro areas.

Labor Market Slack

Preferences for education as expressed in online job ads, however, are not driven exclusively by the type of work available in a given economy and, in fact, change over time. These fluctuations over time have motivated a number of studies that use RTLMI data to research "upcredentialing," defined as the tendency of employers to "seek college graduates for positions that used to require a high school diploma or other sub-baccalaureate training" (Burning Glass Technologies, 2014, p. 1). Not long after the end of the recent recession, when the RTLMI field was in its relative infancy, a *New York Times* Economix blog posting used Burning Glass data to identify the 10 occupations that had experienced the greatest percent increase in requirements for a four-year degree between 2007 and 2012 (Rampell, 2012).

In the intervening years, during which the job market improved dramatically, a number of studies linked the process of upcredentialing to the slack that existed in local labor markets. For example, studies by Modestino, Shoag, and Ballance (2015) and Hershbein and Kahn (2016) find that employers' preferences for highly educated candidates increase more in economies that experience greater increases in unemployment. Further, Modestino, Shoag, and Ballance (2016) show the reverse as well — that preferences for higher levels of education and experience fall slightly when an economy's employment situation strengthens — while Hershbein and Kahn (2016) argue for a structural, rather than a cyclical, interpretation of the trends. Regardless of their root causes, the effects reported in these studies, while relatively small, appear to suggest that employers' pref-

[1] Ross, Svajlenka, and Williams (2014) find that more than 60 percent of registered nurses in the 100 largest metro areas held at least a bachelor's degree between 2009 and 2011. Further, in 2010, the Institute of Medicine of the National Academies (now the National Academy of Medicine) recommended that the share of nurses with at least a bachelor's degree increase from 50 percent to 80 percent by 2020, and evidence indicates that, although still in the minority through 2014, employers were becoming increasingly likely to require nurses to hold a bachelor's degree (National Academies of Sciences, Engineering, and Medicine, 2016, citing reports by the American Association of Colleges of Nursing). Two data sets — reflecting typical entry-level education and the education suggested by a survey of current workers — used to define opportunity occupations in Wardrip et al. (2015) agreed that a bachelor's degree is not generally required to become a registered nurse. Although the former data set has been updated to suggest that a bachelor's degree is typically required to begin working as a registered nurse, associate degree programs, baccalaureate degree completion programs, and community colleges are often used by minority and low-income students to "enter and advance in the field of nursing" and "will remain important for maintaining or increasing the diversity of the nursing workforce" (National Academies of Sciences, Engineering, and Medicine, 2016, p. 73).

[2] Standard Occupational Classification (SOC) codes for these four occupations are 15–1151, 29–1141, 41–1011, and 43–6011, respectively.

erences for college-educated workers are either temporarily or permanently influenced by the business cycle.[3]

While the research presented here is focused not on temporal changes but on explaining differences across metro areas, understanding the mechanisms that influence employers' expressed preferences for education is instructive nonetheless. Moving from the macro to the micro, additional research suggests that factors other than the depth of the labor pool, such as occupational dynamism, also influence the construction of an online job ad.

Occupational Dynamism

Occupations are dynamic, and the skills that a worker needs to compete successfully for a job in one era may be obsolete in the next. A recent report analyzes online job ads for occupations that increasingly require a college degree and finds that for some (e.g., loan officers), the ads asking for a college-educated candidate do, in fact, require more skills or accreditations than ads that do not (Burning Glass Technologies, 2014). This suggests a within-occupation divergence into more sophisticated and less sophisticated versions of the same occupation. Some occupations are also changing over time as employers blend and combine skill sets that may be difficult to find in the labor force. These "hybrid" jobs can require training and expertise generally found in formerly differentiated occupations (e.g., a technology worker may now need greater business acumen than was true in the past) (Burning Glass Technologies and the Council for Adult and Experiential Learning, 2016).

College Degree as Proxy

Occupational divergence and dynamism do not appear to explain upcredentialing in its entirety, however. For some occupations (e.g., IT help desk technicians), the Burning Glass (2014) study finds virtually no difference in skill requirements between the set of ads requesting a college degree and the set seeking a less-educated candidate, suggesting another motive for upcredentialing. Interviews and surveys suggest that some employers prefer college-educated candidates not for their technical skills or knowledge but for soft skills such as leadership, reliability, and the ability to advance that college grads may be more likely to possess: "In other words, companies use credentials like advanced degrees as proxies for soft skills" (Fuller et al., 2014, p. 17). As discussed later, this study is able to test whether the number of soft skills listed in an online job ad is associated with the ad's propensity to request a bachelor's degree.

Bolstering the argument that a college degree might be used as a proxy measure by employers, Clifford and Shoag (2016) present evidence to suggest that restrictions on employers' ability to check the credit file of job applicants may be related to employers' preferences for education. They show that in states in which employers are barred from checking applicants' credit, cities in which the average consumer credit score was below 620 saw the share of job ads requiring a college education rise by an additional 5 percentage points relative to the state. Such a circumstance could be characterized as substituting one proxy (credit quality) for another (a college education) but would be seemingly difficult to attribute to the skills or knowledge required to successfully work in a given field.

No matter the underlying cause of this apparent shift toward higher levels of education for some occupations, the importance of employers' preferences cannot be overstated for workers or their communities. As Rothwell (2012) notes, "The difference in education requirements between existing jobs and open jobs means that many metro areas will have to adjust to the reality that for every retirement, layoff, or expansion, the replacement jobs or new jobs will require more education. This presents a major challenge to many less educated workers and less educated metros" (p. 11).

In this paper, we focus on four opportunity occupations that accounted for more than 5 million jobs in the U.S. in

[3] If preferences for the level of education sought by employers are cyclical, a four-year college degree may be used to "filter" less-educated workers from the pool of eligible candidates when job seekers greatly outnumber open positions; in tighter labor markets, this filter could be removed. However, changes in the business cycle could create permanent changes in employment in one of two ways. First, economists suggest "hysteresis" or that shocks in demand can have longstanding effects on employment conditions — even after the shock has subsided (Bartik, 1991). Another explanation is that cyclical downturns are opportunities for firms to adjust to structural changes that have already taken place (Groshen and Potter, 2003).

2015.[4] Changes in employers' educational expectations for job candidates in these fields could have a significant impact on the ability of many workers without a four-year college degree to earn a decent wage. Commenting on jobs in health care, Ross, Svajlenka, and Williams (2014) express a sentiment that can be more broadly applied to other opportunity occupations when they note that "these jobs are important for efforts to support upward mobility, since they can serve as entry points into the labor force for workers with lower levels of education and potentially open up career ladders" (p. 4). Closing these points of entry for workers without a four-year college degree could negatively affect regional economies, workers' lifetime earnings, and their children's future prospects for decades.

DATA

The data set of online job ads used in this analysis was acquired from Burning Glass Technologies. Burning Glass collects online job ads from over 40,000 websites daily and converts each electronic posting into database format.[5] The data used in this analysis reflect job ads posted between 2011 and 2014. Of the 62 million job ads in the initial data set, we focus on the ads that specify a minimum level of education and were posted in one of the 366 metro areas defined by the Office of Management and Budget in 2009.[6, 7] Roughly 10 percent of the 26.9 million ads meeting our criteria are for positions in the four opportunity occupations analyzed in detail in this report: computer user support specialists (335,000), registered nurses (1.4 million), retail sales supervisors (645,000), and executive secretaries (120,000). These four were chosen both for the sheer number of job ads posted for each occupation and because of the substantial level of metro-to-metro variation in employers' preferences for education that they exhibited.

RTLMI data sets such as the one used in this study include a wide variety of information on the employer posting the job ad, the occupation being advertised, and the type of candidate sought for the position, but the data extracted from each job ad are only as complete as the ad itself and only as accurate as the technology used to extract the information. Even if the data were complete and extracted perfectly, it is widely understood that online job postings do not represent the universe of job openings, nor are they a representative sample. Openings in certain occupations are more likely to be posted on the Internet than are openings in others (Rothwell, 2014; Rothwell, 2012). The level of education required to work in a given occupation also influences its representation in the online marketplace (Emsi, 2015; Carnevale, Jayasundera, and Repnikov, 2014). Additional concern surrounds errors in data extraction (Carnevale, Jayasundera, and Repnikov, 2014) and the removal of duplicate ads, although Milfort and Kelley (2012) suggest that the latter has been at least partly ameliorated as vendor deduplication processes have improved. Finally, it is impossible to know whether the minimum level of education requested in each online job ad is a requirement for employment or simply an employer preference that can be negotiated.

In spite of these imperfections, RTLMI data sets can tell us much about the job openings that are advertised online and the characteristics of the candidates sought by employers.

NATIONAL TRENDS AND METRO AREA VARIATION

Figure 1 aggregates data from across the 366 metro areas and shows the share of online job ads requesting a bachelor's degree or higher for all jobs and for the four opportunity occupations at the crux of this analysis. The overall trend was slightly downward, from 62 percent in 2011 to 57 percent in 2014, a pattern than one would expect to see in a strengthening national labor market and one that is consistent with findings in Modestino, Shoag, and Ballance (2016). The percentage also declined, albeit only slightly, for computer user support

[4] Authors' calculations using May 2015 Occupational Employment Statistics data produced by the U.S. Department of Labor's Bureau of Labor Statistics and available at www.bls.gov/oes/current/oes_nat.htm.

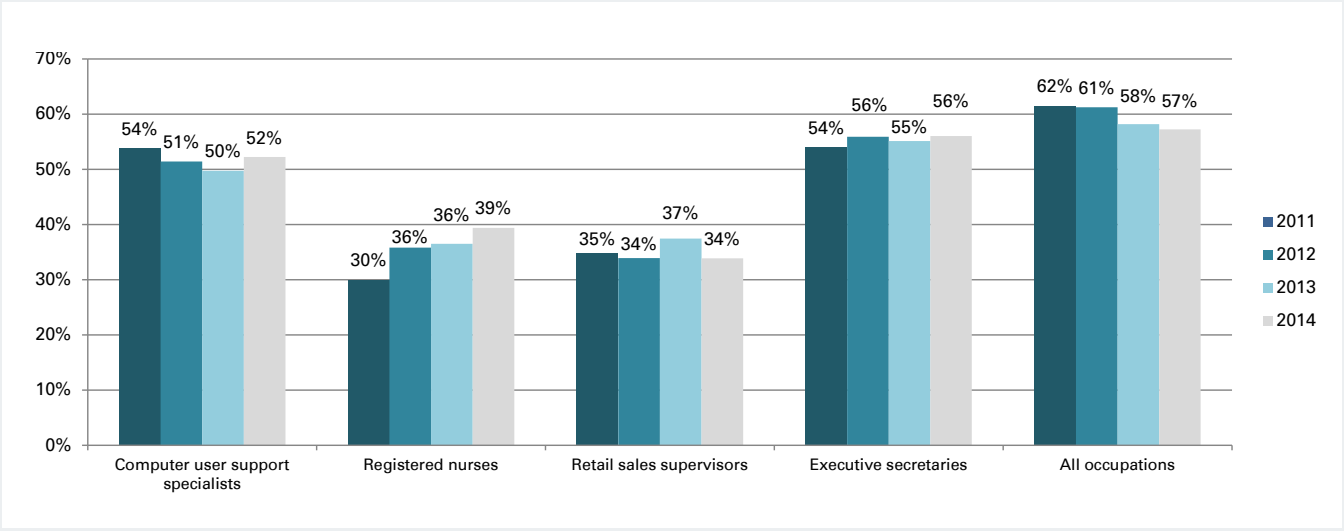
[5] More information on Burning Glass data is available at http://burning-glass.com/.

[6] Half of the job ads posted in metro areas during this period did not include a minimum level of education and were excluded from this analysis. The percentage was comparable for computer user support specialists (48 percent), retail sales supervisors (47 percent), and executive secretaries (43 percent) but much lower for registered nurses (17 percent).

[7] See https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/bulletins/b10-02.pdf for more information on these metro area definitions.

FIGURE 1

Share of Online Job Ads Requesting a Bachelor's Degree or Higher



specialists and retail sales supervisors between 2011 and 2014. The pattern is reversed only modestly for executive secretaries but in the extreme for registered nurses, with the share of job ads requesting a bachelor's degree or higher rising by more than 9 percentage points in three years.

Of particular interest in this study is the dramatic metro-to-metro variation in the tendency for employers to request a bachelor's degree or higher for middle-skills jobs. Reflecting data from the full study period (2011–2014) for each of the four selected opportunity occupations, Figure 2 illustrates the high, low, and midpoint for the metro areas in the study. The median share occupies a fairly narrow range — from 27 to 46 percent — suggesting that in most metro areas, these jobs generally remain accessible to workers without a bachelor's degree. However, the gap between the minimum and maximum is substantial for all four occupations. Understanding this geographic variation is at the heart of this analysis.

EXPLAINING EMPLOYERS' EDUCATIONAL PREFERENCES IN ONLINE JOB ADS

In order to identify the factors that appear to affect the likelihood that employers will request a bachelor's degree or higher in a given job posting, we develop five binary logistic regression models — one for each selected opportunity occupation and one that includes all occupations to serve as a benchmark. Job ads are categorized into two groups: those that request less than a bachelor's degree and those that request a bachelor's degree or higher. We control for a number of characteristics of the jobs themselves, such as the year the ad was posted, the industry of the employer,[8] the level of experience requested,[9] the number and types of skills preferred,[10] and whether the ad was posted by a recruiter.[11, 12]

[8] In each model, we control for the industry of the employer using the three-digit North American Industry Classification System (NAICS) code provided in the data set. There were 99 such codes in the data set, and rather than dropping ads where this information was not available, we created an "unknown" category. While important to control for in the models, the ways in which an employer's industry affects the likelihood of a job ad requesting a bachelor's degree are not discussed in this report. Estimates are available upon request.

[9] For experience, job ads with missing information were retained in the models and assigned to an "unknown" category.

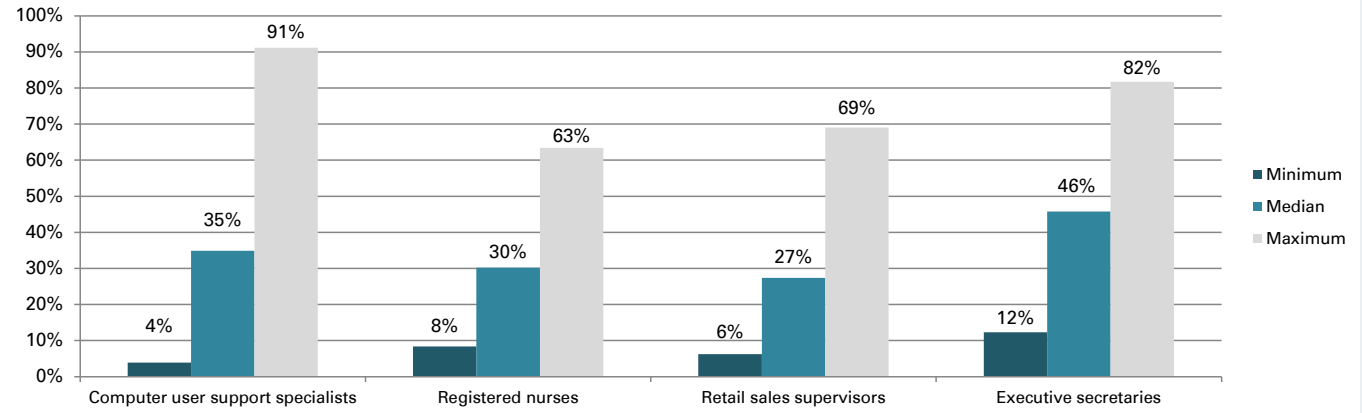
[10] With regard to skills requested, which are included in the models as four separate variables for four distinct types of skills, job ads with no skills extracted by Burning Glass were assigned a value of zero for the type of skill in question.

[11] Correspondence with Burning Glass staff indicates that the absence of an employer's name in the job ad is a good indication that the ad was posted by a recruiter. We incorporate this assumption into our analysis.

[12] In the all-occupations model, in addition to controlling for industry, we also control for the occupation of the job postings.

FIGURE 2

Metro Area Variation in the Share of Online Job Ads Requesting a Bachelor's Degree or Higher



Note: Percentages are calculated only for metro areas with at least 50 online job ads for which a minimum education was available. There were 366 metro areas meeting this criterion for registered nurses and retail sales supervisors, 333 for computer user support specialists, and 191 for executive secretaries.

By controlling for the nuances of the job ads, we can discern whether the characteristics of the metro areas in which the jobs are available have independent effects on employers' preferences for college-educated candidates. As such, the regression models include the census region of the metro area, its population, a measure of recent college completions relative to the size of the labor force, the unemployment rate, the average annual wages, the percent of the population that is foreign-born, and whether a research university is present in the metro area.

More information on the variables used in this analysis can be found in Appendix Tables A1 and A2. Model results are provided in Appendix Table A3.[13]

The percentages reported in Table 1 and the text that follows are known as average marginal effects (AMEs), which can be calculated after conducting logistic regression analysis. AMEs indicate the average change in the probability that a job ad will request at least a bachelor's degree when the independent variable changes by one unit, while keeping all other variables constant. All values discussed here are statistically significant with at least 95 percent confidence ($p < 0.05$). The following summarizes our findings, beginning with the characteristics of the job ads themselves and then turning to the characteristics of the metro areas in which they were posted.

Characteristics of Online Job Ads

Experience: In the all-occupations model and for computer user support specialists, registered nurses, and retail sales supervisors, job ads that request more than one year of experience are more likely to also request a bachelor's degree. In some cases, the AME is substantial — as high as 46.6 percent for retail sales supervisors with more than three years of experience. Further, the effect strengthens as the level of experience increases. The suggestion is that jobs that require more experience also require a higher level of education and, although included in the same occupation, may be the domain of workers with a qualitatively different level of expertise.

[13] Several post-estimation tests were employed to verify our models' variables and fit, to the extent possible for logistic estimation. The Akaike's information criterion (AIC) and Bayesian information criterion (BIC) values, as well as the pseudo-R^2, log-likelihood, and percent correctly classified score for our current models indicated superiority over other iterations with fewer or different variables. Additionally, several other iterations were run using a set of interaction effects and squared versions of our continuous variables, but these did not substantially change the odds ratios or AMEs of our models.

TABLE 1

Average Marginal Effects

	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries	All Occupations
Experience (≤ 1 year is reference)					
1.01–2 years	9.8%	3.9%	11.4%	–5.4%	5.0%
2.01–3 years	18.9%	17.5%	16.5%	–5.1%	10.8%
More than 3 years	30.9%	22.2%	46.6%	–5.8%	16.7%
Unknown	18.4%	–5.0%	12.4%	—	6.2%
Year (2011 is reference)					
2012	–1.8%	4.3%	–1.6%	—	0.5%
2013	–2.3%	5.0%	–0.3%	—	–0.5%
2014	–1.1%	7.9%	–3.0%	—	–0.4%
Specialized software skills	3.7%	–3.7%	7.7%	1.7%	1.2%
Specialized nonsoftware skills	–0.5%	0.2%	–0.2%	–1.1%	0.1%
Baseline software skills	–2.1%	4.9%	7.1%	–2.1%	0.3%
Baseline nonsoftware skills	1.3%	1.7%	–0.7%	0.6%	0.3%
Ad posted by recruiter	—	–4.4%	–0.4%	7.1%	0.8%
Census region (South is reference)					
Northeast	4.2%	8.9%	2.7%	4.8%	1.9%
Midwest	1.3%	3.9%	0.6%	—	0.8%
West	–3.3%	4.6%	2.8%	1.7%	–0.2%
Population (< 250,000 is reference)					
250,000–499,999	3.1%	0.8%	2.3%	–1.7%	0.4%
500,000–999,999	3.8%	—	1.5%	—	0.6%
1,000,000–2,499,999	4.8%	1.3%	3.1%	—	1.3%
2,500,000 and higher	6.2%	4.3%	2.9%	3.7%	2.0%
Degree completions per 1,000 labor force participants (Quartile 1 is reference)					
Quartile 2	4.9%	3.6%	1.7%	3.1%	1.6%
Quartile 3	4.5%	3.8%	1.9%	8.1%	2.2%
Quartile 4	5.6%	2.2%	0.7%	11.0%	2.7%
Average annual wages ($10,000s)	5.0%	2.0%	1.2%	4.5%	1.9%
Unemployment rate	0.6%	—	–0.7%	0.6%	0.0%
Percent foreign born	0.1%	–0.2%	0.2%	0.1%	0.0%
Presence of a research university	0.5%	—	—	–1.6%	0.2%

Notes: AMEs are provided for variables that are statistically significant with at least 95 percent confidence ($p < 0.05$). "—" indicates statistical insignificance.

The reverse is true for executive secretaries. Ads asking for more than one year of experience are between 5 and 6 percent less likely to request a college-educated candidate than are those seeking one year of experience or less. This finding suggests that experience in executive secretarial work can substitute for education.

Year: Although Figure 1 indicates that job ads placed after 2011 for all occupations were increasingly unlikely to request a bachelor's degree or higher, we find very little variation from year to year when controlling for job and metro area characteristics, and findings for the four opportunity occupations are mixed. There is no significant difference across the four years for executive secretaries. However, job ads for registered nurses are 7.9 percent more likely to request a bachelor's degree in 2014 than in 2011; the opposite effect is apparent for employers searching for computer user support specialists and retail sales supervisors, for which ads placed after 2011 are up to 3 percent less likely to request a bachelor's degree or higher. While the findings for registered nurses may be rooted in a structural shift toward higher levels of formal education, less common requests for a college degree for computer user support specialists and retail sales supervisors may be a response to a shallower pool of candidates and a tightening job market.

Skills: In the all-occupations model, the number of skills included in a given job ad is positively associated with the likelihood of requesting a bachelor's degree. This is true for specialized and baseline skills and for software and nonsoftware skills alike.[14] The AME for an additional skill in the all-occupations model is quite small, as is the overall effect. For example, the average number of specialized software skills per job ad is 0.8, and the standard deviation is 2.0. With an AME of only 1.2 percent for each additional skill, variance in the number of skills listed in a job ad has a relatively minor impact on the ad's likelihood of also requesting a bachelor's degree.

The marginal effects for skills in the four opportunity occupations models vary in magnitude and in some cases are negative. Baseline nonsoftware skills, which can be thought of as a proxy for soft skills, are significant and positively associated with the likelihood of the ad requesting a bachelor's degree for three of the four occupations, but the effects are relatively small. More substantial effects can be seen in the results for retail sales supervisors, for which each additional specialized software skill makes the job ad 7.7 percent more likely to request a bachelor's degree, while each baseline software skill increases the likelihood by 7.1 percent.

The positive association between the skills sought by an employer and the likelihood of the employer asking for a bachelor's degree is intuitive on one level. Because certain skills are frequently acquired through the course of a college education, job ads requesting additional skills could also be expected to request a bachelor's degree. On the other hand, it could be argued that the ability to demonstrate certain skills could supersede a four-year college degree, during the pursuit of which those skills may or may not have been developed.

Recruiter: Online job ads that do not include the name of the employer, which is used in this analysis to indicate posting by a recruiter, are only marginally more likely to request a bachelor's degree or higher overall. The effects are substantially larger and positive for executive secretaries (7.1 percent) but negative for registered nurses (−4.4 percent) and retail sales supervisors (−0.4 percent).

Characteristics of Metro Areas

Census Region: Overall and compared with job ads placed in the South, ads placed by employers in the Northeast and Midwest regions are more likely to request a bachelor's degree, whereas job ads posted in the West are marginally less likely to do so. For the four opportunity occupations, the effects are substantial in the Northeast, ranging from 2.7 percent for retail sales supervisors to 8.9 percent for registered nurses. In the occupation-specific models, with a couple of exceptions, ads placed in the Midwest and West are generally more likely to request a bachelor's degree than ads placed in the South, although the effects tend to be smaller than in the Northeast.

Population: Overall and for computer user support specialists and retail sales supervisors, job ads placed in larger metro areas are consistently more likely to

[14] For illustrative purposes, the most common skills in the full data set in December 2014 include SQL, JAVA, and Oracle (specialized software); sales, repair, and accounting (specialized nonsoftware); Microsoft Excel, Office, and Windows (baseline software); and communication skills, organizational skills, and writing (baseline nonsoftware).

request a bachelor's degree than similar ads placed in metro areas with a population below 250,000. This finding is significant in all models for the largest metro areas (≥ 2.5 million residents) and ranges from 2.0 percent in the all-occupations iteration to 6.2 percent for computer user support specialists. The effects are consistently larger for computer user support specialists and retail sales supervisors than in the all-occupations model.

Degree Completions: Across the board, employers placing ads in metro areas with a relatively higher number of bachelor's and advanced degree completions are significantly more likely to request a bachelor's degree than are employers in metro areas with relatively fewer recent college grads. Compared with ads placed in metro areas that rank among the bottom fourth on this measure, ads placed in metro areas among the top fourth are 2.7 percent more likely to request a bachelor's degree overall. The effect is smaller (but still significant) for registered nurses (2.2 percent) and retail sales supervisors (0.7 percent) but much larger for computer user support specialists (5.6 percent) and executive secretaries (11.0 percent).

Average Annual Wages: Across the models, a metro area's average annual wages is positively associated with the likelihood that a job ad requests a bachelor's degree. An increase of $10,000 in average metro area wages leads to a 1.9 percent greater likelihood in the all-occupations model; the effects are comparable for registered nurses (2.0 percent) and retail sales supervisors (1.2 percent) but substantially larger for computer user support specialists (5.0 percent) and executive secretaries (4.5 percent).

Surprisingly, the unemployment rate in the metro area in the year prior to the ad being posted has negligible and mixed effects on the level of education specified in the job ad. The same is true for the share of a metro area's population that is foreign born and the presence of a research university.

Rather than testing the effects of metro area characteristics on the likelihood that an employer will request a bachelor's degree or higher, the sidebar shows how the likelihood varies across specific metro areas in relation to Atlanta. The sidebar table lists the AMEs for a number of metro areas in comparison with the Atlanta metro area after controlling for the year the online job ad was posted, the experience and skills requested in the ad, and whether the ad was posted by a recruiter. The percentages indicate the extent to which job ads in a given metro area are more or less likely to request a bachelor's degree or higher than comparable job ads in a reference metro area — in this case, Atlanta.

It is worth noting that the all-occupations model is markedly more successful at correctly classifying job advertisements as requesting a bachelor's degree or not than are the occupation-specific models (83.5 percent overall versus a high of 76.0 percent for retail sales supervisors; see the row "Correctly classified" in Table A3). Undoubtedly, this is because, for many of the occupations included in the all-occupations model, the level of education requested in the job ad exhibits little variation. Including ads for occupations that can be more easily classified as requiring at least a bachelor's degree (e.g., lawyer) or not (e.g., fast food prep) allows the all-occupations model to more frequently predict the level of education requested.

The other side of the coin is that, in spite of all of the job- and metro area-level characteristics they include, the models are able to successfully classify the job ads as requesting a bachelor's degree or not only two-thirds of the time, give or take, for the four opportunity occupations analyzed in this research. This suggests that the level of education truly required to enter these professions is not a settled issue, and that factors not included in our models — and perhaps not quantifiable at all — affect the way job ads for opportunity occupations are written.

SUMMARY

According to the Bureau of Labor Statistics, each of the nearly 138 million jobs held by American workers can be classified into one of more than 800 different occupations.[15] Even with a classification system so fine-grained, this research suggests that significant variation exists when it comes to the preferred educational attainment of prospective candidates for these narrowly defined jobs — both within and across metro areas.

This analysis finds that overall and for three of the four opportunity occupations examined, employers that ask

[15] See www.bls.gov/soc/ and www.bls.gov/oes/ for more information.

METRO AREA VARIATION FOR COMPARABLE JOB OPENINGS

As the table shows, employers' preferences for a bachelor's degree for computer user support specialists are generally higher in Atlanta than elsewhere; in only six metro areas do employers' preferences for education significantly exceed Atlanta's. The reverse is true for retail sales supervisors, where the likelihood of a job ad requesting a bachelor's degree in other metro areas generally exceeds the likelihood in Atlanta. For all four occupations, employers' preferences for a bachelor's degree are significantly higher in Boston, New York City, San Francisco, and San Jose. For three of the four occupations in Charleston, SC, Columbia, SC, Lansing, MI, and Miami, job candidates without a college degree are more likely to meet employers' expectations than they are in Atlanta.

Average Marginal Effects for Specific Metro Areas (versus the Atlanta Metro Area)

	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries
Akron, OH	–17%	—	—	
Albany–Schenectady–Troy, NY	–18%	6%	4%	
Albuquerque, NM	–16%	–10%	—	
Austin–Round Rock–San Marcos, TX	–6%	6%	7%	–32%
Baltimore–Towson, MD	–12%	6%	3%	—
Boston–Cambridge–Quincy, MA–NH	6%	9%	3%	13%
Bridgeport–Stamford–Norwalk, CT	11%	—	6%	
Charleston–North Charleston–Summerville, SC	–22%	–7%	–3%	
Charlotte–Gastonia–Rock Hill, NC–SC	—	–13%	—	
Chicago–Joliet–Naperville, IL–IN–WI	—	4%	—	11%
Cincinnati–Middletown, OH–KY–IN	–14%	3%	—	
Cleveland–Elyria–Mentor, OH	–7%	15%	—	
Colorado Springs, CO	–16%	22%	—	
Columbia, MO	–63%	—	–11%	
Columbia, SC	–34%	–8%	–5%	
Columbus, OH	–7%	–2%	4%	
Dallas–Fort Worth–Arlington, TX	–10%	–3%	3%	—
Denver–Aurora–Broomfield, CO	–6%	16%	2%	—
Des Moines–West Des Moines, IA	–18%	10%	–4%	
Detroit–Warren–Livonia, MI	—	2%	–2%	
Durham–Chapel Hill, NC	—	–11%	—	
Hartford–West Hartford–East Hartford, CT	–11%	10%	2%	
Honolulu, HI	–15%	–9%	—	
Houston–Sugar Land–Baytown, TX	–4%	3%	2%	–29%
Huntsville, AL	–19%	–17%	—	
Indianapolis–Carmel, IN	–6%	–4%	—	
Jacksonville, FL	–9%	–7%	—	
Kansas City, MO–KS	–14%	—	—	

	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries
Lansing–East Lansing, MI	–38%	–8%	–8%	
Las Vegas–Paradise, NV	–26%	–14%	4%	
Los Angeles–Long Beach–Santa Ana, CA	–5%	5%	3%	14%
Louisville/Jefferson County, KY–IN	–20%	–5%	—	
Miami–Fort Lauderdale–Pompano Beach, FL	–9%	–9%	5%	–10%
Milwaukee–Waukesha–West Allis, WI	–12%	–5%	—	
Minneapolis–St. Paul–Bloomington, MN–WI	–8%	11%	9%	
Nashville-Davidson–Murfreesboro–Franklin, TN	–11%	–14%	—	
New York–Northern New Jersey–Long Island, NY–NJ–PA	5%	18%	10%	19%
Oklahoma City, OK	–11%	–6%	—	—
Omaha–Council Bluffs, NE–IA	–11%	7%	6%	
Orlando–Kissimmee–Sanford, FL	–14%	10%	—	
Philadelphia–Camden–Wilmington, PA–NJ–DE–MD	—	2%	7%	10%
Phoenix–Mesa–Glendale, AZ	–17%	6%	3%	
Pittsburgh, PA	–8%	6%	4%	
Portland–Vancouver–Hillsboro, OR–WA	–7%	18%	—	
Raleigh–Cary, NC	–7%	9%	—	
Richmond, VA	–22%	–5%	4%	
Rochester, NY	–22%	6%	3%	
Sacramento–Arden-Arcade–Roseville, CA	–10%	—	6%	
St. Louis, MO–IL	–6%	–10%	2%	
Salt Lake City, UT	–28%	–4%	7%	
San Antonio–New Braunfels, TX	–27%	–15%	—	
San Diego–Carlsbad–San Marcos, CA	–8%	12%	3%	
San Francisco–Oakland–Fremont, CA	5%	2%	11%	27%
San Jose–Sunnyvale–Santa Clara, CA	6%	6%	19%	22%
Seattle–Tacoma–Bellevue, WA	–13%	11%	21%	—
Tampa–St. Petersburg–Clearwater, FL	–10%	5%	—	–36%
Trenton–Ewing, NJ	7%	12%	5%	
Virginia Beach–Norfolk–Newport News, VA–NC	–15%	—	—	
Washington–Arlington–Alexandria, DC–VA–MD–WV	–3%	3%	5%	8%

Notes: The AMEs provided in this table were produced by models that controlled for experience, the year of the job ad placement, the number and types of skills included in the job ad, and whether the ad was posted by a recruiter. Rather than controlling for industry, we used the two-digit NAICS code provided in the data set to restrict the sample to job ads in each occupation's most prevalent industry (professional, scientific, and technical services for computer user support specialists; health care and social assistance for registered nurses; retail trade for retail sales supervisors; and educational services for executive secretaries). Estimates were produced for the 60 metro areas that had at least 200 observations for computer user support specialists, registered nurses, and retail sales supervisors. There were 200 job ads for executive secretaries in only 18 of these 60 metro areas; cells for the 42 metro areas with an insufficient number of observations are shaded dark gray. Estimates provided in the table are significant with at least 95 percent confidence ($p < 0.05$), and "—" indicates statistical insignificance.

for more prior work experience are also more likely to request a bachelor's degree. Prior work experience has the largest effect on whether or not a job ad requests a bachelor's degree, and the positive association between the two suggests that some positions simply require a higher level of expertise than other positions within the same occupation. For executive secretaries, on the other hand, the negative relationship between education and experience in online job ads suggests that employers are willing to accept one as a substitute for the other. Other job characteristics, such as the year the job was posted and the number of skills sought, have generally negligible effects overall and inconsistent — albeit sometimes larger — effects in the occupation-specific models.

It is conceivable that after controlling for industry, experience, timing, and skills, metro area differences in employers' preferences for a bachelor's degree would disappear. This is not the case. Our analysis finds that place still matters when it comes to employers' expectations for the educational attainment of the ideal job candidate. Even after controlling for the characteristics of the posted jobs, employers' educational preferences are higher where recent college graduates are relatively more numerous, where wages are higher, in larger metro areas, and in the Northeast. In these types of markets, a job seeker sometimes needs more education to get a foot in the door than does a candidate for a similar job elsewhere.

One question left unanswered by this research is whether the spatial variation in employers' preferences for education can be explained by factors not included in our analysis. For example, while our regression models control for the number and types of skills listed in each job posting, it may be that specific, highly valued skills are in greater demand in certain types of metro areas than in others. More effectively controlling for specific skills or other, unobservable characteristics of the jobs, employers, or local economies (such as firm size or the clustering of certain industries or occupations) could conceivably improve our models and mute any effects ascribed to the characteristics of the metro areas in which the ads are posted.

Another unanswered question pertains to the roughly half of all online job ads posted during this period for which the minimum level of education was unknown. We find these job ads listed fewer skills, on average, than the ads that we analyzed. Since job ads with fewer skills were generally less likely to request a bachelor's degree in the overall model (results were mixed for the four individual occupations), the ads excluded from this analysis could be more likely to represent viable opportunities for less-educated applicants.

PRACTICAL IMPLICATIONS

The finding that online job ads are more likely to request a four-year college degree in higher-wage, larger, more educated metro areas than in others may have several explanations. The first is that, in spite of our efforts to control for differences in job openings, workers may simply need a level of expertise in these types of economies that can only be learned on a college campus. For example, an executive secretary at a multinational firm in a large metro area may be expected to regularly interact with executives from different countries and thus require a different level or set of soft skills than others classified in the same occupation but in a different setting. A second possible explanation is that employers may place educational expectations on occupations in order to limit applicants to, or discriminate in favor of, those workers very similar to those already employed at the firm (Becker, 1994). Lastly, employers in these types of markets may advertise for a more highly educated candidate than the job necessitates because the labor pool is deep enough and educated enough to accommodate this preference.

No matter the explanation, workers who lack a bachelor's degree appear to have relatively fewer opportunities in some places than in others, even for occupations that have not historically demanded this level of education. Expanding job opportunities for these workers, however, requires clarity on the mechanisms that create differential access for workers with lower levels of formal education. Where employers' preferences for college-educated talent are more pervasive and can be attributed to requirements for different skills, workforce development providers may be able to customize programs to meet this demand and thereby circumvent the necessity for a four-year degree.

A number of sectoral training partnership programs have shown positive outcomes for workers filling middle-skills

occupations. Maguire et al. (2010) studied Per Scholas, an organization that trains workers to fill IT support positions in short-term training programs that put jobseekers into these occupations without conferring degrees. This model has also been applied in construction trades, medical billing, and health care among others. These programs are built to accommodate the needs of employers and help to prove that, in many cases, the skills and competencies these positions require can be taught without a formal degree. Sectoral training partnership programs can change the perspective of participating employers, but they are not a silver bullet. These programs can be difficult to scale up, even within a single regional economy. Moreover, even within the same industry, employers' needs may vary across regions, and industry recognition of any credentials or certifications conferred through these programs may be complicated by uncertainty surrounding the skills that they signify.

If, however, engagement with employers suggests that the preference for college-educated job candidates is not skills-based, efforts to improve employment access for workers who lack a four-year degree may need to begin with the employers themselves. Research shows that when job ads request a bachelor's degree or higher, the position takes longer to fill (Rothwell, 2014; Burning Glass Technologies, 2014) — a proposition that can lead to increased workloads and lower morale for existing staff, unfinished work, and negative repercussions for customer service and work quality (CareerBuilder, 2014). Efforts by nonprofits to serve as the intermediary — or matchmaker — between less-educated workers and employers by vetting and vouching for job seekers aim to overcome existing barriers in the hiring process but these efforts are difficult to scale. The willingness of employers to rethink hiring practices and to tap into new segments of the labor market, however, could dramatically expand access to decent-paying jobs for workers who lack a four-year college degree.

The level of education that an employer requests in an online job ad is likely a function of both national and regional trends. Occupations are dynamic, and their continual evolution means that a profession's next generation of workers may need a different skill set than was necessary for those they are succeeding. As this research suggests, the set of skills required in one metro area may be slightly different than the skills required in another. Workforce development programs that can keep abreast of these national trends — and how they play out locally — alongside a demonstrated willingness by employers to look for talent in previously overlooked segments of the labor force could expand opportunity for tomorrow's workers and strengthen regional economies across the country.

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TABLE A1

Descriptive Statistics for Discrete and Continuous Variables in Logistic Regression Models

Variable	Source	Years	N	Mean	Median	Standard Deviation	Minimum	Maximum
Specialized software skills	Burning Glass Technologies	2011–2014	26,850,784	0.79	0	2.04	0	70
Specialized nonsoftware skills	Burning Glass Technologies	2011–2014	26,850,784	5.16	4	4.16	0	140
Baseline software skills	Burning Glass Technologies	2011–2014	26,850,784	0.49	0	0.93	0	12
Baseline nonsoftware skills	Burning Glass Technologies	2011–2014	26,850,784	3.22	3	2.73	0	39
Unemployment rate	U.S. Department of Labor's Bureau of Labor Statistics, Local Area Unemployment Statistics	One year prior to job ad (2010–2013)	26,850,784	8.09%	7.91%	1.92%	2.68%	28.86%
Average annual wages*	U.S. Department of Labor's Bureau of Labor Statistics, Quarterly Census of Employment and Wages	One year prior to job ad (2010–2013)	26,850,784	$5.23	$5.10	$1.14	$2.85	$9.76
Percent foreign born	U.S. Census Bureau, American Community Survey One-Year Estimates	Two years prior to job ad (2009–2012)	26,850,784	15.13%	12.88%	9.65%	0.38%	38.82%

* Using data for all covered employment, average annual wages for a metro area are calculated by summing total wages and dividing by average employment for the metro's constituent counties. The variable was then divided by 10,000 for easier interpretation.

TABLE A2

Distribution of Categorical Variables in Logistic Regression Models

Variable	Source(s) and Year(s)	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries	All Occupations
Education (dependent variable)	Burning Glass Technologies (2011–2014)					
Less than a bachelor's degree		48.29%	64.19%	64.93%	44.69%	40.72%
Bachelor's degree or higher		51.71%	35.81%	35.07%	55.31%	59.28%
Experience	Burning Glass Technologies (2011–2014)					
≤ 1 year		16.33%	26.42%	20.31%	7.62%	14.48%
1.01–2 years		17.25%	18.15%	18.40%	12.98%	12.56%
2.01–3 years		13.20%	11.30%	12.55%	16.27%	11.43%
More than 3 years		27.61%	6.98%	16.09%	39.37%	30.01%
Unknown		25.62%	37.17%	32.65%	23.76%	31.51%
Year	Burning Glass Technologies (2011–2014)					
2011		23.04%	23.05%	21.87%	22.03%	22.84%
2012		21.01%	18.42%	20.44%	20.69%	20.60%
2013		27.14%	26.12%	27.18%	26.31%	26.61%
2014		28.81%	32.41%	30.51%	30.98%	29.94%

Table A2 continued

Variable	Source(s) and Year(s)	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries	All Occupations
Ad posted by recruiter	Burning Glass Technologies (2011–2014)					
No		68.96%	70.27%	84.63%	66.16%	71.71%
Yes		31.04%	29.73%	15.37%	33.84%	28.29%
Census region	U.S. Census Bureau					
South		35.49%	38.98%	34.98%	30.38%	33.50%
Northeast		19.34%	15.87%	19.24%	25.33%	19.74%
Midwest		21.86%	19.03%	20.92%	18.07%	21.40%
West		23.31%	26.13%	24.86%	26.23%	25.36%
Population	U.S. Census Bureau, Population Estimates Program (average, 2010–2013)					
< 250,000		6.68%	9.83%	10.62%	4.75%	7.24%
250,000–499,999		7.81%	10.99%	10.91%	6.47%	8.61%
500,000–999,999		11.48%	13.99%	13.52%	8.94%	11.60%
1,000,000–2,499,999		20.69%	20.07%	18.99%	17.58%	20.03%
2,500,000 and higher		53.34%	45.12%	45.96%	62.27%	52.52%
Degree completions per 1,000 labor force participants*	U.S. Department of Education's National Center for Education Statistics, Integrated Postsecondary Education Data System and U.S. Department of Labor's Bureau of Labor Statistics, Local Area Unemployment Statistics (average, 2010–2013)					
Quartile 1		4.74%	8.88%	9.10%	3.60%	5.99%
Quartile 2		30.05%	35.54%	29.23%	26.36%	30.22%
Quartile 3		53.43%	44.35%	50.08%	56.77%	52.33%
Quartile 4		11.79%	11.24%	11.60%	13.26%	11.46%
Presence of a research university†	Carnegie Basic Classification data accessed via U.S. Department of Education's National Center for Education Statistics, Integrated Postsecondary Education Data System (2010)					
No		32.14%	41.41%	38.98%	25.13%	33.10%
Yes		67.86%	58.59%	61.02%	74.87%	66.90%
Total observations		334,869	1,424,433	645,072	119,593	26,850,784

* This measure includes bachelor's, master's, and doctoral degrees but excludes degrees granted by institutions that are primarily online or offer distance-learning educational opportunities. Metro areas are assigned to one of four equal groups, with the ratio of degree completions to labor force participants lowest in quartile 1 and highest in quartile 4.

† This measure includes the 104 universities classified as having "very high research activity" located in metro areas in 2010.

TABLE A3

Odds Ratios and Standard Errors for Binary Logistic Regression Models

	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries	All Occupations
Experience (≤ 1 year is reference)					
1.01–2 years	1.613***	1.201***	2.089***	0.786***	1.453***
	(0.023)	(0.007)	(0.022)	(0.022)	(0.003)
2.01–3 years	2.475***	2.168***	2.751***	0.794***	2.272***
	(0.037)	(0.014)	(0.031)	(0.022)	(0.005)
More than 3 years	4.458***	2.652***	12.182***	0.770***	3.666***
	(0.061)	(0.020)	(0.137)	(0.019)	(0.007)
Unknown	2.423***	0.778***	2.209***	0.996	1.585***
	(0.032)	(0.004)	(0.021)	(0.026)	(0.003)
Year (2011 is reference)					
2012	0.914***	1.240***	0.909***	1.037	1.041***
	(0.011)	(0.007)	(0.009)	(0.020)	(0.002)
2013	0.891***	1.283***	0.982**	1.006	0.962***
	(0.010)	(0.007)	(0.009)	(0.019)	(0.002)
2014	0.947***	1.469***	0.836***	1.035	0.969***
	(0.012)	(0.009)	(0.008)	(0.020)	(0.002)
Specialized software skills	1.206***	0.834***	1.594***	1.077***	1.107***
	(0.003)	(0.006)	(0.013)	(0.009)	(0.001)
Specialized nonsoftware skills	0.976***	1.010***	0.987***	0.953***	1.011***
	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)
Baseline software skills	0.900***	1.266***	1.533***	0.909***	1.023***
	(0.003)	(0.006)	(0.007)	(0.004)	(0.001)
Baseline nonsoftware skills	1.067***	1.088***	0.958***	1.028***	1.023***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.000)
Ad posted by recruiter	0.986	0.808***	0.978**	1.376***	1.069***
	(0.010)	(0.004)	(0.009)	(0.021)	(0.002)
Census region (South is reference)					
Northeast	1.238***	1.533***	1.179***	1.241***	1.173***
	(0.016)	(0.010)	(0.012)	(0.025)	(0.002)
Midwest	1.067***	1.212***	1.038***	1.010	1.071***
	(0.012)	(0.007)	(0.010)	(0.020)	(0.002)
West	0.848***	1.251***	1.184***	1.077***	0.984***
	(0.010)	(0.006)	(0.011)	(0.020)	(0.002)

Table A3 continued

	Computer User Support Specialists	Registered Nurses	Retail Sales Supervisors	Executive Secretaries	All Occupations
Population (< 250,000 is reference)					
250,000–499,999	1.168***	1.040***	1.149***	0.928**	1.036***
	(0.025)	(0.009)	(0.016)	(0.035)	(0.003)
500,000–999,999	1.206***	1.004	1.099***	0.964	1.048***
	(0.025)	(0.008)	(0.015)	(0.035)	(0.003)
1,000,000–2,499,999	1.272***	1.065***	1.210***	1.022	1.113***
	(0.027)	(0.009)	(0.018)	(0.037)	(0.003)
2,500,000 and higher	1.365***	1.234***	1.193***	1.180***	1.183***
	(0.030)	(0.012)	(0.019)	(0.044)	(0.004)
Degree completions per 1,000 labor force participants (Quartile 1 is reference)					
Quartile 2	1.278***	1.196***	1.110***	1.147***	1.140***
	(0.028)	(0.010)	(0.015)	(0.043)	(0.003)
Quartile 3	1.250***	1.205***	1.123***	1.430***	1.202***
	(0.028)	(0.010)	(0.015)	(0.054)	(0.003)
Quartile 4	1.321***	1.113***	1.047***	1.630***	1.254***
	(0.033)	(0.011)	(0.017)	(0.068)	(0.004)
Average annual wages ($10,000s)	1.288***	1.099***	1.074***	1.224***	1.175***
	(0.008)	(0.003)	(0.005)	(0.011)	(0.001)
Unemployment rate	1.031***	1.001	0.960***	1.025***	1.004***
	(0.003)	(0.001)	(0.002)	(0.005)	(0.000)
Percent foreign born	1.003***	0.992***	1.009***	1.007***	1.001***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Presence of a research university	1.025**	1.007	0.995	0.930***	1.014***
	(0.012)	(0.005)	(0.010)	(0.019)	(0.002)
	(Industry controls not reported)				(Industry and occupation controls not reported)
Observations	334,868	1,424,400	645,072	119,582	26,843,450
Correctly classified	68.81%	68.28%	75.99%	63.40%	83.52%
Cragg & Uhler's R^2	0.276	0.135	0.344	0.130	0.614
Log-Likelihood	–193,134	–855,111	–325,298	–76,083	–9,987,470
AIC	386,516	1,710,450	650,844	152,411	20,000,000
BIC	387,846	1,711,838	652,255	153,593	20,000,000
LR test Prob > x^2	0.000	0.000	0.000	0.000	0.000

*** $p < 0.01$; ** $p < 0.05$

Note: The number of observations reported in Tables A1 and A2 can be higher than in Table A3 because the model drops ads for jobs in industries in which the binary variable is consistently 0 or 1 for all cases.

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