



Northeastern University

School of Public Policy & Urban Affairs

Final Report

Russell Sage Foundation Future of Work Program

“Upskilling During the Great Recession:
Why Do Employers Demand Greater Skill When Workers
Are Plentiful?”

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Future of Work - The program in the Future of Work is concerned primarily with examining the causes and consequences of the declining quality of jobs for less- and moderately-educated workers in the U.S. economy and the role of changes in employer practices, the nature of the labor market and public policies on the employment, earnings, and the quality of jobs of American workers.

Executive Summary

Our previous research funded by the Russell Sage Foundation (award #85-14-05) demonstrated that employers raised education and experience requirements within middle-skill occupations during the Great Recession in response to increases in the supply of relevant job seekers based on data from a large database of online job postings (Modestino, Shoag, and Balance, *Labour Economics* 2016). Yet our earlier work could not distinguish among alternative explanations for employers raising requirements. For example, employers may have engaged in upskilling during the recession to provide a filter for the high number of applications that they received in response to business cycle conditions. Alternatively, employer upskilling may have been driven by a desire to strategically acquire top talent, perhaps in response to longer-term structural factors such as changes in regulation, technology, or global competition that accelerated during the recession. These varying motivations have different implications for policies trying to help certain groups, like the long-term unemployed. The latter motivation suggests that employers actively value education and experience or that it makes workers more productive while the first rationale suggests that these traits may be substitutable with other, more efficient, signals.

In this project, we explored the mechanisms behind rising employer skill requirements by addressing the Foundation's interest in developing qualitative evidence to uncover the determinants of employer hiring behavior. Specifically, we conducted one-on-one interviews with roughly 40 firms in Massachusetts with a concentration on four primary industries: manufacturing, healthcare, finance, and the life sciences. These sectors have a substantial number of middle skill jobs, and are industries in which structural factors such as technology, organizational structure, product market competition, and/or federal regulations have been changing. Our aim is to shed light on the degree to which labor market slack versus these structural factors are important in explaining recent changes in skill requirements by employers.

Across industries we found that skill requirements are indeed changing and that these positions have become more difficult to fill as the economy has recovered. However, there is a high degree of heterogeneity in the strategies that firms undertake to fill these positions when they have difficulty filling a vacancy. In some industries, such as manufacturing, employers are willing to lower skill requirements and train less-qualified workers while in others, such as healthcare, firms seek to develop relationships with community colleges and training programs to develop talent pipelines. Finally, all employers that we interviewed highlighted a need for greater soft skills across all levels of their organizations in response to higher demand for teamwork, customer service, and analytics.

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I. Motivation to Conduct Additional Qualitative Research

Like most downturns, the Great Recession and subsequent recovery have been particularly painful for low-skilled workers. From 2007 to 2012, the unemployment rate rose by 6.4 percentage points for non-college workers, relative to an increase of only 2.3 percentage points for the college educated. Perhaps less well-known, this differential was also evident within occupations. According to the American Community Survey, college educated workers were 2 percentage points less likely to be unemployed from 2007 through 2012 within six-digit occupational codes. Indeed, Figure 1 shows that during this period, the share of workers with a college degree increased rapidly within middle- skill occupations.¹ This growth in skill levels within occupations has colloquially become known as “upskilling.”²

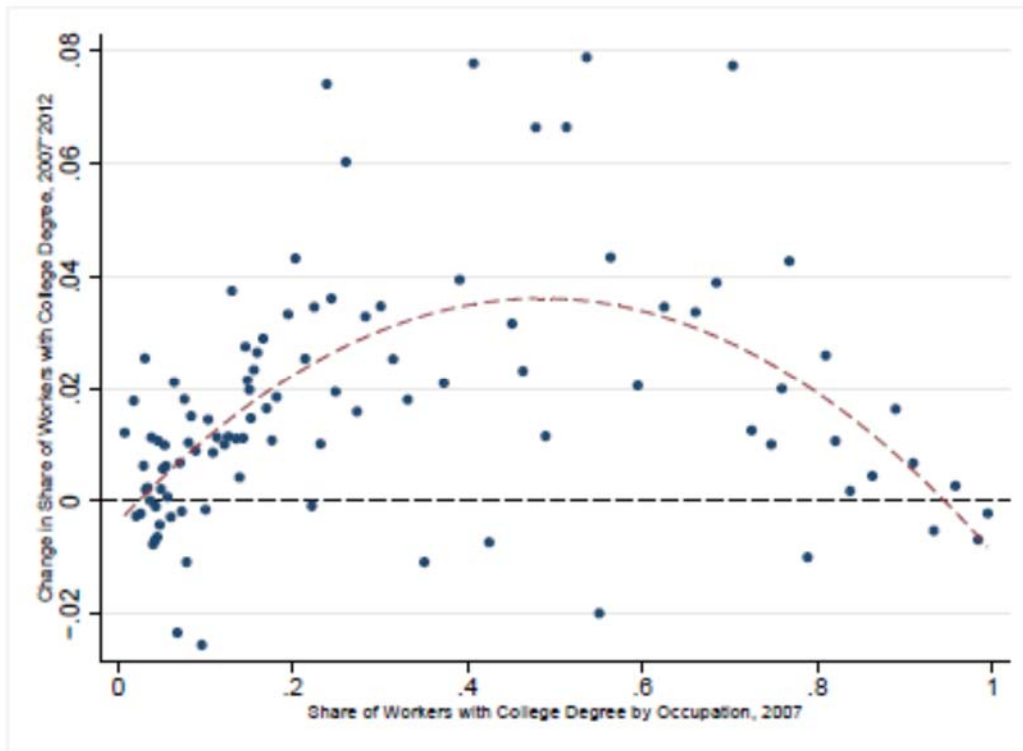
Our previous research funded by the Russell Sage Foundation showed that employers engaged in this upskilling behavior by raising education and experience requirements within middle-skill occupations during the Great Recession in response to increases in the supply of relevant job seekers (Modestino, Shoag, and Balance 2015). Specifically, the share of employers requiring a Bachelor’s degree or five or more years of experience rose more rapidly in states that experienced a greater increase in the unemployment rate. This relationship is robust to numerous tests for potentially confounding factors, and is present even within firm-job title pairs. We

¹ Following Holzer and Lerman (2007), we define middle-skill jobs as those that generally require some significant education and training beyond high school but less than a bachelor’s degree. These postsecondary education or training requirements can include associate’s degrees, vocational certificates, significant on-the-job training, previous work experience, or generally “some college” without having earned a degree. Following Modestino (2010), we use data on the educational attainment of incumbent workers from approximately 485 occupations available in the American Community Survey, we identify 272 “middle-skill” occupations as those occupations in which more than one-third of the workers have some college or an associate’s degree.

² While the observed increase in the share of workers with a college degree within occupations may be partially explained by an increase in the share of all workers with a college degree, data on changes in educational attainment suggest this is unlikely. From 2007 through 2012 the fraction of the prime age (25-65) population with a college degree rose by approximately 1.3 percentage points. However, within middle-skill occupations—defined as those where 40% to 60% of workers held a college degree in 2007—this share rose by 3.3 percentage points, a rate roughly 2.5 times as fast. Carnevale (2012) similarly documents that traditionally low-, middle-, and high-skill occupations all hired a greater share of college-educated workers during the current economic recovery than before the recession.

further identified this effect by exploiting a natural experiment arising from troop-withdrawals in Iraq and Afghanistan as an exogenous shock to local, occupation-specific labor supply. When faced with a greater number of veterans seeking work, employers in relevant occupations raised their skill requirements, shutting returning veterans out of these positions. Our results suggest that an increase in the number of people looking for work accounts for roughly 30 percent of the total increase in employer skill requirements between 2007 and 2010.

Figure 1. Change in the Share of Workers with a College Degree by Occupation, 2007-2012, versus Initial Share in 2007



Source: Author’s calculations of share of worker's with a college degree by occupation calculated using the ACS 1yr PUMS, IPUMS-USA, 2007 and 2012.

Note: Figure is a binned scatter plot, N=100.

What forces might be driving this employer behavior? Our earlier work provides several clues. First, we show that the college wage premium for new hires falls as unemployment rises, which may motivate firms to increase their skill requirements when they can hire new talent “on

the cheap.” Second, we also found that the degree of unemployment-related-upskilling across industries and states is consistent with a causal effect of opportunistic employer searching. In particular, Table 1 shows that upskilling is larger when average turnover rates are lower, when time-to-start horizons are more delayed, and when other margins like wages are less flexible. Third, our most recent work shows that employer skill requirements for education and experience have declined as the labor market tightened during the subsequent recovery between 2010 and 2014 (Modestino, Shoag, and Balance 2016).

Table 1. Relationship between the Change in Employer Requirements and Labor Market Slack by Firm Characteristics

	Change in Share of Postings Requesting a Bachelor's Degree or Greater				Change in Share of Postings Requesting 2 or More Years of Experience			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ State UR	0.901*** (0.260)	0.0583 (0.293)	-0.0702 (0.320)	0.406 (0.260)	1.712*** (0.236)	-0.0753 (0.249)	0.476* (0.275)	0.445* (0.229)
Δ State UR \times Occ. Turnover Rate	-0.0191*** (0.00394)				-0.0438*** (0.00403)			
Δ State UR \times Time to Start	0.00769*** (0.00205)				0.0146*** (0.00209)			
Δ State UR \times Initial Hrly. Wage Premium	1.066*** (0.370)				0.517 (0.316)			
Δ State UR \times Occ. Union Concentration	0.0132*** (0.00452)				0.0546*** (0.00626)			
Occ Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6519	5567	6475	6519	6519	5567	6475	6519

Source: Modestino, Shoag, and Balance (2014).

Notes: The dependent variable for columns (1)- (4) is the percentage point change in the share of posting requesting a Bachelor's degree or greater and the percentage point change in the share of postings requesting 2 or greater years of experience for columns (5)--(8) in Panels A and B. The Occupation Turnover rate is a national detailed occupation-level measure for the annual replacement needs over the period 2012-2022 as a share of 2012 employment. Time to Start is an industry level measure for the average time it takes to fill a position (in days). The industry-level estimates are matched to occupations in our sample. Occupation union concentration is a national detailed occupation-level measure for the share of employees covered by a collective bargaining agreement as reported by the Current Population Survey. The initial hourly wage premium is a state by detailed occupation-level measure, calculated by taking the log difference in the 75th and 25th percentiles of hourly wages as reported by BLS Occupational Employment Statistics in 2007. See the data appendix for additional details on variable construction. All specifications include a control for differences between the two time periods, 2007{2010 and 2010{2012. Columns (4) and (8) also include the initial wage premium (state by detailed occupation level of variation). Observations are State \times Occupation cells containing at least 15 job posting in both periods for which the change is measured and are weighted by the occupation's share of each state's total postings. Standard errors (in parentheses) clustered by state. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While these clues are suggestive, our earlier work cannot clearly distinguish among alternative explanations for employers raising requirements. For example, anecdotes in the popular press suggest employers may engage in upskilling because recruiters believe that “[w]hen you get 800 resumes for every job ad, you need to weed them out somehow”³ or because firms find that “[t]he recession is a wonderful opportunity to acquire top talent.”⁴ The latter motivation might be driven by longer-term structural factors such as changes in regulation, technology, or global competition that accelerated during the recession. These differing motivations have different interpretations for both economic models and policies. The latter motivation suggests that employers actively value education and experience or that it makes workers more productive while the first rationale suggests that these traits may be substitutable with other, more efficient, signals.

In this project, we extended our earlier work to explore the mechanisms behind rising employer skill requirements. In doing so, we addressed the Foundation’s interest in developing qualitative evidence to uncover the determinants of employer hiring behavior more generally covering both formal (e.g. use of background checks and pre-employment testing for screening) and informal (e.g. use of internal or external networks for recruitment) methods. Specifically, our aim with this project was to answer the following research questions:

1) What institutional features are correlated with changing employer skill

requirements and why do they matter? Do particular firm characteristics make upskilling more or less likely (e.g. industry, employer size, employment growth, wage growth)? Why are certain institutional features associated with a greater degree of upskilling (e.g. turnover rates, internal promotion, wage setting practices)?

³ Suzanne Manzagol, recruiter for admin positions in Atlanta as quoted in Green (2009).

⁴ Barry Deutsch, chief executive of Impact Hiring Solutions as quoted in Green (2009).

- 2) **Does “upskilling” occur along other, harder to measure, dimensions of skill requirements?** Conditional on requiring a given level of education, has the share of employers requiring other types of skills (e.g. software skills, supervision skills, customer service skills) also risen—particularly for middle-skill occupations? How do employers determine whether individuals have these other types of skills (e.g. certifications, digital badges, pre-employment tests, behavioral tests, interviews)?
- 3) **What were the motivations for employers to change their skill requirements during the Great Recession?** Did employers respond to changes in the supply of available workers or were other motivations at work as well (e.g. adoption of new technology, change in policy or regulation, global competition)? Did the degree of upskilling vary across skill levels for a given employer (e.g. do they respond differently to low- versus high-skill supply constraints)?
- 4) **Did recession-induced upskilling lead to a permanent shift in requirements for middle-skill jobs?** Do firms view rising skill requirements during the Great Recession as a permanent shift, and if so, why? During the Great Recession, were employers able to require more skill without raising wages? As skill requirements increased during the Great Recession, did the duties associated with these jobs change as well?
- 5) **If employers have experienced difficulty filling vacancies as the labor market has recovered, what actions have they taken?** As the labor market has tightened, did firms raise wages for middle-skill jobs or are there constraints to doing so (e.g. competitive pressures, regulations, fairness to incumbent workers)? Alternatively, did firms reduce skill requirements to fill middle-skill positions? Or did they outsource, automate, or offshore these jobs? Finally, have employers trained and promoted incumbent low-skill

workers from within the firm? What types of training do employers currently offer (e.g. onboarding, workplace safety, diversity/inclusion, technical/professional)?

We believe that the answers to these questions are important for advancing the economics discipline in the fields of both labor and macroeconomics. A mature literature has looked at polarization of outcomes by skill, routine, and non-routine occupations in both the U.S. (Katz and Murphy 1992; Autor, Katz, and Kearney 2006; Autor and Dorn 2012) and Europe (Goos and Manning 2007). A more recent literature has explored the extent of mismatch (Sahin et al. 2014) and rising polarization across industries and occupations during recessions (Autor 2010, Foote and Ryan 2014, Jaimovich and Siu 2014, Tuzeman and Willis 2013). Moreover, although the traditional middle of the job market – composed primarily of construction, production and clerical jobs that require fairly little education – has indeed been declining rapidly, another set of middle-skill jobs – requiring more postsecondary education or training - in health care, mechanical maintenance and repair and some services – has been growing (Holzer 2015). Our research focuses on a feedback mechanism between labor supply and the selectivity of vacancies that may be related to these broader trends, but also operates within detailed occupations.

Collecting qualitative data from employers to study the actual recruitment process as it occurs within firms can help bridge the gap between observable employer behavior and the highly abstract search models developed by economists. In particular, understanding the mechanisms behind the upskilling trend can shed light on macroeconomic models with heterogeneous workers (Shi 2002, Albrecht and Vrooman 2002) and employer search decisions (Davis, Faberman, and Haltiwanger 2012). The sensitivity of skill requirements to applicants and its correlation with average turnover, hiring delays, and flexibility is consistent with a model with costly applicant screening and heterogeneous employer surplus. Our work also builds on a

small, but growing literature on online vacancies (Gautier, van der Berg, van Ours, and Ridder 2002, Marinescu and Wolthoff 2013, Hershbein and Kahn 2015).

Finally, it is important for policymakers to understand whether the changes in employer skill requirements that occurred during the recession have led to permanent changes in demand for workers with such qualifications. If the change in employer requirements was largely driven by the state of the labor market, then the observed increase in more skilled workers filling lower-skill jobs may be temporary. One would expect that this type of opportunistic upskilling would reverse itself once aggregate employment recovers and the labor market tightens. Conversely, if changing employer requirements arose from structural forces such as regulation, technology adoption, or global competition that changed the kinds of tasks performed in these jobs, then these effects might be more permanent with adverse implications for entry-level or less-skilled workers who are unemployed.

II. Qualitative Data Collection and Methodology

To tackle these questions, we conducted one-on-one interviews with roughly 40 firms in Massachusetts with a concentration on four primary industries: manufacturing, finance, healthcare and the life sciences. These sectors have a substantial number of middle skill jobs, and are industries in which structural factors such as technology, organizational structure, product market competition, and/or federal regulations have been changing. The goal was to shed light on the degree to which labor market slack versus these structural factors are important in explaining recent changes in skill requirements by employers.

A. Sample Selection and Recruitment

We initially established working relationships with six different organizations from which we received access to recruit participants for interviews from their membership rosters. These

included the Greater Boston Chamber of Commerce, the Boston Healthcare Careers Consortium, the Boston Tooling & Machining Association, the Massachusetts Bankers Association, the Massachusetts Life Sciences Center, and MassBioEd. (See Exhibit A in the appendix for more details on each of these organizations.) We also made use of existing networks within each of our respective universities through a combination of student placement and co-operative education offices. Finally, in the case of the life sciences industry we found it necessary to engage in snowball sampling where we asked existing study subjects to recruit future subjects from among their professional industry networks.⁵

In general, the participants were human resource professionals or CEOs in the manufacturing, healthcare, finance, and life sciences industries representing firms that ranged in size from small (fewer than 50 employees) to mid-size (50-100 employees) to large (100-500 employee) to very large (greater than 1,000 employees). To date, we have completed over 30 interviews and reached saturation in three of the four industries. Although verifying saturation is somewhat subjective, most qualitative researchers agree it has been achieved when (a) no new or relevant data seem to be emerging regarding a category, (b) the category is well developed in terms of its properties and dimensions demonstrating variation, and (c) the relationships among the categories are well established and validated (Strauss and Corbin 1998). The exception was the life sciences industry for which it was difficult to identify and recruit participants due to a lack of centralized hiring within those firms, resulting in only four interviews completed to date. As a result, we have been using a snowball sampling technique to recruit additional participants and expect to conduct at least 3-5 additional interviews in the life sciences industry.

⁵ Snowball sampling was necessary in the life sciences industry as very few firms in the industry have a centralized hiring and recruitment process making it difficult to determine who might be an appropriate subject to interview within each employer.

B. Interview Protocol and Instrument Development

Pilot interviews were conducted to test our survey instrument across different industries and firm sizes to determine what revisions might be needed before deploying our interview instrument more widely. Each interview lasted approximately one hour and covered a set of topics and questions that were sent in advance. These were based on a detailed script that was used to guide each interview (see Exhibit B in the appendix). We found it helpful to refer to specific examples of upskilling throughout our interview using references to popular news articles or industry publications that the participants could relate to. Using these examples as a frame of reference, we could then objectively ask participants if they had observed similar situations in their firms or within the industry. This seemed to be an effective way to get participants to directly address our questions around upskilling in addition to their general observations about changes in hiring practices and job requirements.

We found that participants could most easily address our questions in the context of one or two specific jobs with which they had the most experience recruiting for. Initially, we used the vacancy data provided to us by Burning Glass Technologies to identify specific jobs within each industry that exhibited upskilling between 2007 and 2010 to directly ask participants about their experiences recruiting for those types of jobs. For example, in the finance industry, jobs such as bank teller, personal banker, and business analyst have increased their education requirements, with many positions now asking for a Bachelor's degree. In the healthcare industry, administrative assistant and nurse manager have also shifted to requiring a four-year college degree. In the manufacturing and life sciences industries, employers increasingly asked for more years of experience among machinists and lab technicians respectively. We subsequently asked them to provide us with the actual job postings to clarify and provide additional background.

The pilot interviews also revealed that participants could provide general answers in terms of trends they observed but did not have detailed data on these positions at their fingertips. To address this, we drafted a brief survey that was sent in advance to help participants better prepare for the interview questions and collect common responses across interviews. Employers were asked a number of questions related to job vacancies at their establishments including the number and types of positions open for immediate hire, the work experience required for those positions, the educational requirements for those positions, and whether those positions are full-time, permanent or temporary (see Exhibit C in the appendix). In addition, some of the questions on the survey were also asked of a national sample of employers as part of the National Study of Employers conducted this past March by the Families and Work Institute. As such, we can also benchmark some of the participants' survey response to those of a nationally representative sample of employers to determine the extent to which our results can be generalized beyond Massachusetts and the specific industries and firms that were interviewed here.

B. Coding and Analysis

All interview were transcribed and coded using NVivo software. Using standard methods, we initially used the pilot interviews to begin coding the responses into major categories of information using open coding. These included obvious categories such as: Firm Context, Hiring, Qualifications, Upskilling, Downskilling, and Training. From this initial open coding, we identified several open coding categories to focus on (e.g., "core" phenomenon) and then went back to the data and created categories around these core phenomena consisting of causal conditions (what factors caused the core phenomenon), strategies (actions taken in response to the core phenomenon), contextual and intervening conditions (broad and specific situational factors that influence the strategies), and consequences (outcomes from using the strategies).

These categories were further refined and expanded in an iterative process as we conducted additional interviews to arrive at a final coding hierarchy (see Exhibit D in the appendix).

III. Findings by Industry

We initially examined each of the four industry groups separately to better understand the structural context within which firms were making decision about hiring and skill requirements. This approach allowed each industry's story to develop without being constrained by the pre-conceived hypotheses of the aggregate trend that we observed in the quantitative data from our earlier work.

A. Manufacturing

Several recent news articles have highlighted the need for a college degree in many occupations that previously did not require one, including manufacturing. Citing the need for advanced math and comprehension skills and the ability to solve problems on the fly, executives at large manufacturing corporations such as Eric Spiegel of Siemens have stated that “There are no jobs for high school graduates at Siemens today.”

But is it really the case that the average manufacturing worker needs a four-year college degree to be successful on the factory floor? Other manufacturing leaders assert that apprenticeship programs would be a better fit for the type of advanced training program needed for manufacturing. And a national survey of manufacturers found that roughly three-quarters of employers have no difficulty filling vacancies (Osterman and Weaver 2012). Indeed, our previous research suggests that employers exhibit some degree of flexibility around job requirements for both education and experience in middle-skill jobs such as those typically found in manufacturing, depending on the supply of labor that is available.

To learn about changes in skill requirements and hiring practices in manufacturing, we interviewed human resource managers and directors as well as several CEOs/owners at nine manufacturing firms in the Greater Boston area. Most of these individuals had been with their firms for more than five years and all of them had worked in the manufacturing industry for most of their careers (see Table 2). All of the firms we spoke to had been in business for more than 10 years, many over 20 years, and the larger firms for over 50 or even 100 years. Firms ranged in size across the spectrum from small (less than 10 employees) to mid-sized (11-99 employees), to large (100-500 employees) to very large (over 500 employees). Only the two largest firms had locations in other parts of the U.S. or abroad. Regardless of size, all of the Boston area locations were engaged in precision manufacturing for industry or government customers that required significant design, machining, and engineering skills rather than mass production. Most firms provided precision manufacturing products and services to customers in the aerospace, defense, semi-conductor, architectural, medical, and energy sectors.

None of the firms we talked to required formal education beyond a high school degree for their entry level production positions. Instead, hands-on experience in specific types of machinery and manufacturing processes was emphasized when searching for the ideal candidate. Yet, even these qualifications were often modified to fill positions if there was difficulty filling a vacancy—such as when the labor market tightened after the Great Recession. Employers expressed a surprising willingness to train individuals with the right work ethic and mechanical aptitude even if they lacked experience or formal knowledge. This finding supports the hypothesis that manufacturing firms will engage in upskilling of job requirements such as years of experience and specific skillsets when they perceive that such workers are readily available,

Table 2. Characteristics of Manufacturing Firms Interviewed

Title of Person Interviewed	Years of Employment with Firm	Description of Products and Services	Years Firm in Business	Number of Establishments/ Locations	Number of Employees	Typical Entry-Level or Middle-Skill Position (s)	Currently hiring at time of interview
Director of Human Resources	More than 5 years	Produce a range of components for the medical, defence, aerospace, and semi-conductor industries.	40	1	51-99	CNC Swiss Screw Machinist	Yes
President	More than 5 years	Provide custom machining services including CNC and conventional turning, CNC and conventional milling, and gear cutting services.	50	1	25-49	Skilled Machine Operator	Yes
Human Resources Director	More than two years but less than five years	Provide grinding services, heat treating, laser marking, saw cutting, including the manufacture of precision bars, and ultra-precise gages.	60	5	100-499	Machinist, Grinder	Yes
Director, Manufacturing Partnership	More than 5 years	Precision manufacturing of components and assemblies for the medical device, semiconductor, military, aerospace, and energy sectors.	50	1	51-99	CNC Machinist	Yes
Owner	More than 5 years	Turning, milling, sheet metal, engineered solutions, prototype, 3D Profiling, water jet, fabrication, laser engraver, quality, assembly, inventory solutions	20	1	25-49	CNC Machinist, Welder/Fabricator	Yes
Human Resources Manager	More than 1 year but less than 2 years	Aviation division of a large manufacturer.	100+	Many locations worldwide	500+	CNC Machinist, Calibration technician	Yes
Talent Acquisition Manager	More than 5 years	R&D headquarters for a large manufacturer.	100+	Many locations worldwide	500+	Plant Technician, Engineer	Yes
Owner	More than 5 years	Laser cutting, drilling, welding, marking/etching/engraving, rotary cutting, ablation, and secondary processing or finishing of materials for the medical device, clean tech, microelectronic, aerospace, architectural, and woodworking industries.	20	1	25-49	Laser Operator	Yes
President	More than 5 years	Complex and custom plastics fabrication such as forming, extruding, welding, and machining the full range of plastic materials for design environments such as architectural, display, industrial, and furniture design, lighting, and signage.	48	1	Less than 10	CNC Machinist, Craftsman	No

Source: Data collected by the authors' through surveys and interviews.

but that these changes are not necessarily a permanent shift—at least for the middle-skill jobs studied here.

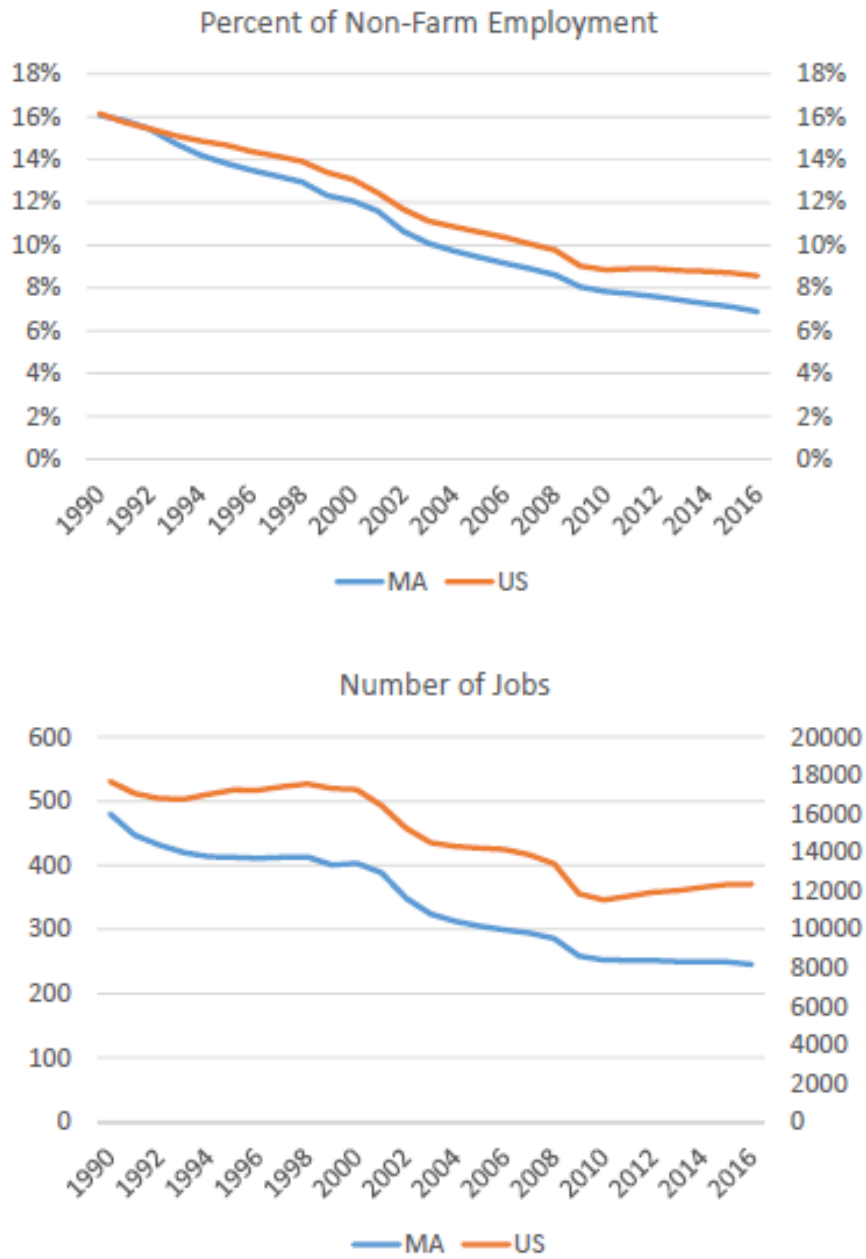
All of the firms we interviewed also talked about global competition in manufacturing as an ongoing trend that was affecting their business and the types of workers that they required. In particular, the need for workers with the ability to continually adapt and learn on the job was essential, particularly among smaller firms which tended to compete for smaller, customized jobs. These secular trends in the manufacturing industry for both the U.S. and Massachusetts are discussed in greater detail in the next section to provide some context for the insights shared by our interview subjects.

Industry Overview and Context

Since the 1990s, manufacturing has comprised an ever-shrinking share of total employment both nationwide and in Massachusetts. Whereas manufacturing represented roughly 16 percent of jobs in both the U.S. and Massachusetts in 1990, that share had fallen to 8.6 percent in the U.S. and 6.9 percent in Massachusetts by 2016 (see Figure 2). Moreover, this represented a decrease in the absolute number of jobs as well with manufacturing employment falling by 30 percent in the U.S. and by 49 percent in Massachusetts.

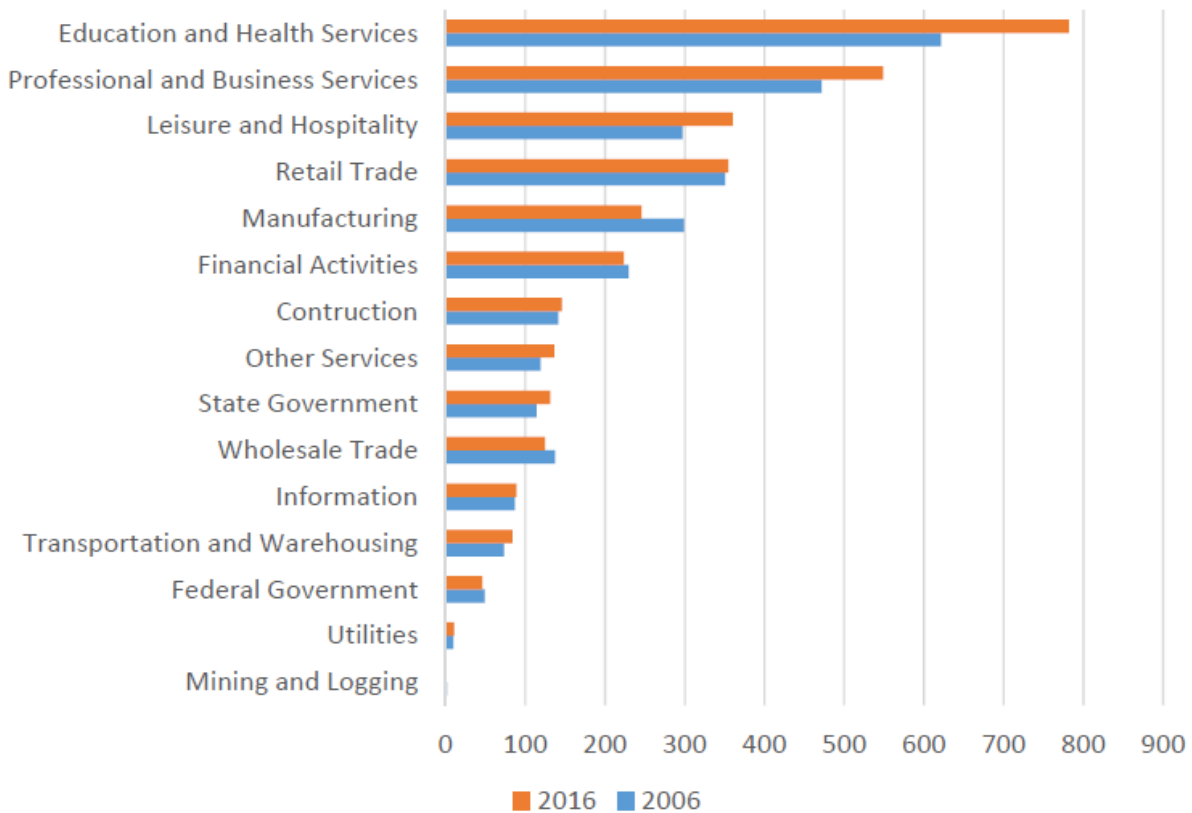
More recently, manufacturing employment has ticked up a bit since the end of the Great Recession but still remains below its pre-recession levels. In Massachusetts, manufacturing is one of only three industries that has not recovered all of the jobs lost during the most recent downturn, although the other two industries are much currently closer to their pre-recession peaks (see Figure 3). As of 2016, manufacturing was the fifth largest sector in the state, behind education and health services, professional and business services, leisure and hospitality, and

Figure 2. Manufacturing Employment, Massachusetts versus the U.S.



Source: U.S. Bureau of Labor Statistics.

Figure 3. Massachusetts Employment by Sector

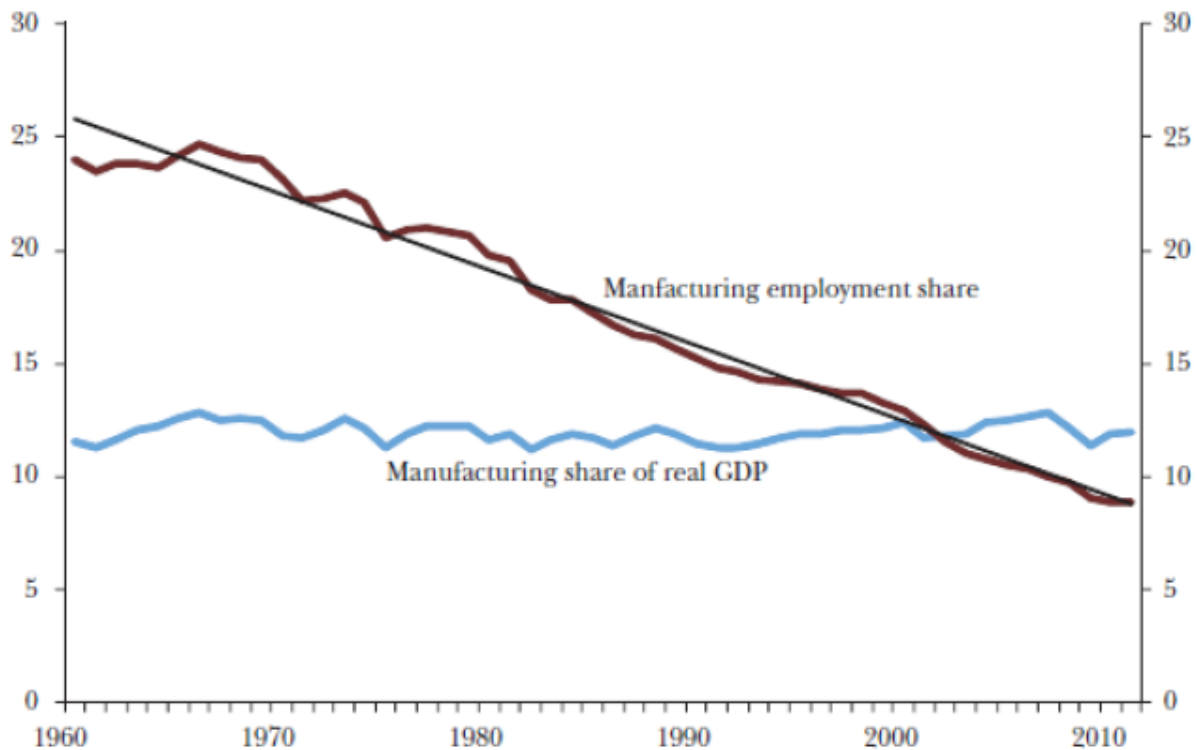


Source: U.S. Bureau of Labor Statistics.

retail trade. The 2014-2024 Bureau of Labor Statistics employment projections indicate that, if anything, the number of manufacturing jobs is likely to decline slightly in the coming decade. Yet contrary to popular belief that the manufacturing sector is shrinking, total output at U.S. factories is up 150 percent over the last 40 years. Yet, U.S. manufacturing jobs have plunged by more than 30 percent in that same period. Indeed, recent studies show that the growth of real output in the US manufacturing sector, measured by real value added, has equaled or exceeded that of total GDP, keeping the manufacturing share of the economy constant in price-adjusted terms despite a long-standing decline in the share of total employment attributable to manufacturing (see Figure 4). This trend has continued even after the Great Recession. Since 2009, manufacturing output — the value of all the goods that U.S. factories produce, adjusted for

inflation — has risen by more than 20 percent but manufacturing employment is up just 5 percent.

Figure 4. Manufacturing Value Added and Employment as a Share of the Total US Economy, 1960–2011 (in 2005 prices)



Source: Bailey and Bosworth (2014). Industry Accounts of the Bureau of Economic Analysis.
Note: Output is measured as value added in 2005 prices, and employment is reported as persons engaged in production (full-time equivalent employees plus the self-employed).

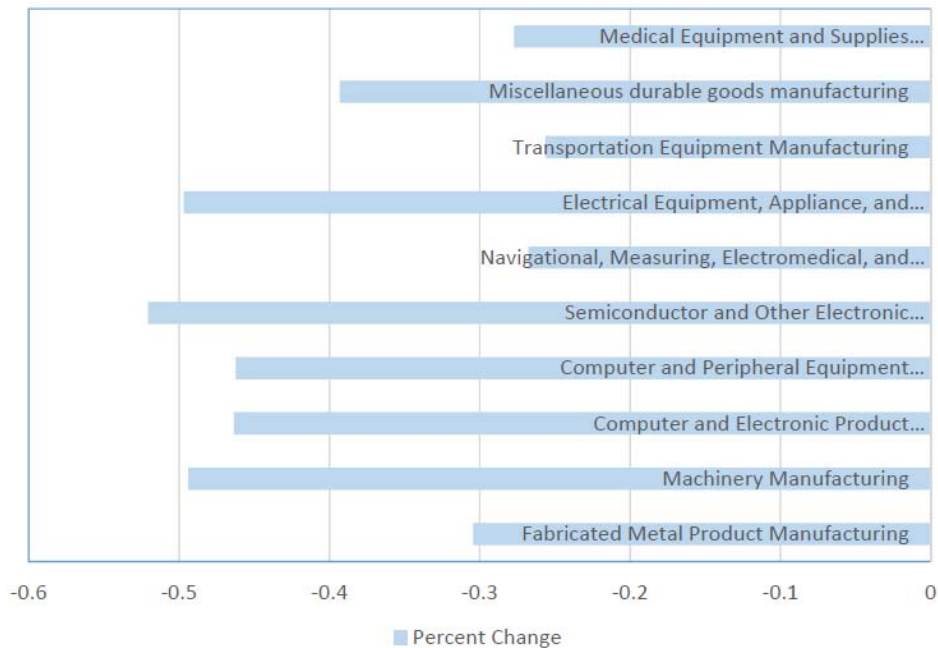
Recent Trends in the Manufacturing Labor Market

The secular decline in manufacturing employment reflects an ongoing dynamic within the industry as products that were once mass-produced in the U.S. are now either produced abroad in countries where labor is cheap and plentiful or in automated factories. For example, output of apparel in the U.S. has dropped more than 80 percent since 1980s, and that of textile mills has fallen about 50 percent since 2000. In contrast, output of computers and electronics has

more than doubled, accounting for most of the growth in manufacturing since the late 1980s (Bailey and Bosworth 2014).

Moreover, manufacturing employment has fallen since 2000 within all of the underlying sub-sectors, including computers and electronics where the largest job losses have occurred (see Figure 5). Part of the decline can be attributed to American firms increasingly shifting away from the prior model of large integrated production units to focus on product design and marketing. They contract with firms that are part of the regional production network in Asia, and undertake little of their own mass production. For example, about half of China’s trade is accounted for by processing activities, which are based on the duty-free import of goods to be assembled and re-exported. Autor, Dorn, and Hanson (2013) estimate that China’s improved competitive position between 1991 and 2007 explained at least 25 percent of the decline of US manufacturing employment during that period, and about 40 percent during the 2000s.

Figure 5. Change in Employment, 2000-2016



Source: Bureau of Labor Statistics.

The development of transnational production networks means that capital and technology are now mobile, and firms can search for the optimal combinations of skilled and unskilled labor and preferred institutional arrangements. As a result, workers and firms are now exposed to much more intense global competition, resulting in the loss of nearly 6 million manufacturing jobs in the U.S. since 2000. Indeed, offshoring and outsourcing replaced many U.S. manufacturing workers during the 1990s and 2000s. However, in recent years, off-shoring has been slowing and even reversing itself according to data from the Reshoring Initiative, a nonprofit trade organization. In the past five years, about a hundred thousand manufacturing jobs have returned to the U.S. from overseas, sixty percent of them from China.

At the same time, the pace of automation has accelerated as the manufacturing that remains in the U.S. has become increasingly capital-intensive. Looking ahead, emerging technologies in manufacturing go beyond industrial robots and automation to include additive manufacturing such as 3D printing; advanced design of digital prototypes; direct interconnections over the Internet between sensor and machines; materials science and biotechnology (e.g. nano-manufacturing); and energy production. While these technologies have the potential to increase US-based output in many sectors of manufacturing, the number of net new jobs that would be created remains an open question. These advances could reduce the number of jobs for a given level of output, but at the same time, the advantage in labor costs currently held by Asian assembly and manufacturing companies would be reduced or eliminated, allowing some amount of production to be re-shored to the United States.

Yet even if we see a growing trend towards re-shoring manufacturing jobs, the types of skills need to fill those jobs is unlikely to resemble those from the factory floor two decades ago. U.S. manufacturers have increasingly moved to more specialized production that involves

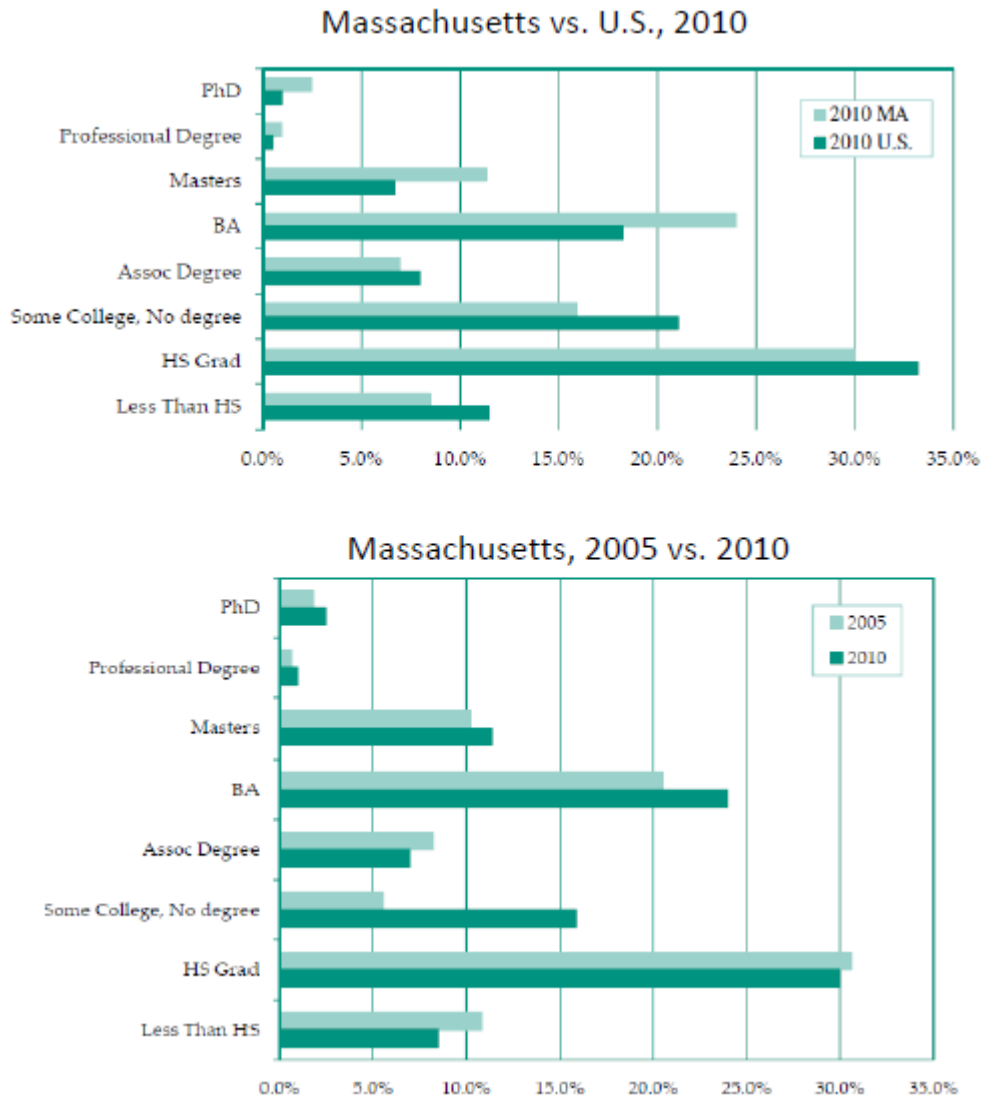
greater precision, customized fabrication, and R&D activities. Along with increasing automation, the types of jobs in the manufacturing sector have shifted from low-skilled factory line positions to those requiring more-skilled workers to operate complex machinery and be involved in additional phases of the production process including design and quality control. This shift is quite apparent in Massachusetts where a recent report found that the share of high-tech employment in manufacturing had grown from 19.8 percent in 1970 to 31.2 percent in 2010 (Dukakis Center for Urban and Regional Policy, 2012).

Indeed, the share of workers with some post-secondary education has been increasing since the 1990s along with the wage premium associated with such workers (Modestino 2010). As of 2016, about one-third of manufacturing workers had a college degree of some type including associate's degrees for installation, maintenance, and repair workers as well as Bachelor's degrees for engineers and managers (see Figure 6). Massachusetts manufacturing workers are substantially more likely than their U.S. counterparts to have completed college, received a Master's degree, a professional degree, or a Ph.D. In 2010, nearly 39 percent of the state's manufacturing workers had at least a Bachelor's degree, compared with just 26 percent in the U.S. and this share has been increasing over time (Dukakis Center for Urban and Regional Policy, 2012).

However, the greater educational attainment of manufacturing workers in Massachusetts reflects the occupational mix of the state. More than 21 percent of the Massachusetts manufacturing workforce are in managerial positions compared to just 16 percent for the U.S. as a whole (Figure 6). Similarly, more than 15 percent of the manufacturing jobs in the state are held by engineers and scientists compared to 11 percent nationwide. At the other end of the occupational spectrum, more than half (54.9%) of the U.S. manufacturing workforce are "blue

collar,” working in construction and extraction; installation, maintenance, & repair; production occupations; or in transportation and material moving jobs. In Massachusetts, less than 42 percent of the manufacturing workforce is found in such occupations.

Figure 6. Educational Attainment, Manufacturing Full-Year Workers



Source: American Community Survey, Dukakis Center for Urban and Regional Policy 2012.

A number of employer surveys and industry reports have highlighted potential labor market mismatches within the manufacturing sector. For example, in an October 2011 survey of American manufacturers conducted by Deloitte Consulting LLP, respondents reported that 5

percent or 600,000 jobs remained unfilled because they could not find workers with the right skills. Of these manufacturers, 74 percent reported that work-force shortages or skills deficiencies in production positions such as machinists, craft workers and technicians were keeping them from expanding operations or improving productivity.

Compounding the problem is a demographic shift where a significant portion of the existing workforce consists of baby boomers nearing retirement with fewer younger workers to replace them. For example, at Boeing, 28 percent of the firm's 31,000 machinists are older than 55 and eligible for retirement. Yet industry leaders say that it is difficult to attract younger workers to an industry that was once considered "dying" and "dirty" and machine shop classes have largely been cut from the high school curriculum as the focus has shifted towards college preparation. In addition, many of these newer middle-skills jobs, such as precision welding, require a non-trivial science and math knowledge such that manufacturing is now considered a STEM occupation.

Although manufacturers say the lack of skilled workers has pushed up wages, they argue that raising them too far would make outsourcing a more attractive option. Last year, the Philadelphia Fed's survey of manufacturers asked employers what they were doing to address the skills mismatch. Almost two-thirds of manufacturers said they were increasing their recruitment efforts, while just over half reported they were training their existing staff. Only about a third reported that they were increasing salaries.

However, it may be the case that the employers responding to the surveys are the "squeaky wheels" of the labor market and do not represent the norm. Osterman and Weaver (2014) directly measure employer skill demands and hiring experiences using a nationally representative survey at the industry level. They find that demand for higher-level skills is

modest at best and that three quarters of manufacturing establishments do not show signs of hiring difficulties.

Changes in Skills Requirements for Middle-Skill Manufacturing Jobs

During our interviews, we primarily focused on entry level jobs for which the firm did the most hiring with an emphasis on “middle-skill” jobs that typically require some vocational or post-secondary training but less than a Bachelor’s degree. For most firms entry level jobs included positions such as machine operator, CNC machinist, grinder, fabricator, gear cutter and laser operator (see Table 2). Somewhat more skilled positions for middle-skill jobs included quality assurance technician, plant technician, and warehouse coordinator. The two largest firms also recruited for entry level positions that required a Bachelor’s degree such as engineer and manager. All of the positions we talked about were full-time permanent positions with benefits. All but one of the smallest firms were recruiting for these positions at the time of the interview.

Typical Middle-Skill Jobs in Manufacturing

The most common job that we talked about with employers was that of a CNC (computer numeric controlled) machinist to produce parts and tools from metal, plastic, or other materials. CNC equipment is precision machinery use to cut, grind, or drill material. The basic responsibilities of a machinist is to be able to read a set of blueprints for a given product, program and set-up the machine specifications to produce the product, and operate the machine to produce the product. The machinist must also be able to monitor the status of the production process, verify the conformance of dimensions to blueprint specifications using inspection equipment, monitor the wear and efficiency of the machine, and perform basic routine maintenance. Machinists are also expected to troubleshoot any problems and also optimize new set-ups to produce products as efficiently as possible.

Other middle-skill positions are more highly specialized such as gear-cutter. Gear cutters must be able to set-up and run gear cutting machines to produce precision gears to certain standard industry specifications. Gear cutters need to understand gear terms and dimensions, measure cut gears, and setup complex machinery - attention to detail is critical. The one employer with an opening was asking for someone with five years' experience but said he could not find one even after a nationwide search.

More managerial type middle-skill positions include estimator, plant technician, and qualified assurance technician. An estimator is responsible for analyzing drawings and specifications to determine the material, machines, labor and process requirements that are used to prepare quotes for bidding on new jobs. A plant technician or operations manager is responsible for organizing work and materials flow, maintaining control of drawings, and organizing training. A qualified assurance technician selects products for test at specified stages in production process for qualities such as dimensions, performance, mechanical, electrical, or chemical characteristics. They maintain test data and customer reports, apply quality control procedures, and recommend modifications to achieve optimum quality within limits of equipment capability. These three positions typically require a minimum of 3-5 years of experience in that particular role in a manufacturing, machining, or fabricating environment as well as knowledge of basic computer software such as Microsoft Excel and Word. In addition to a high school degree employers often look for individuals with post-secondary college courses related to industrial or mechanical engineering. One large employer reported a preference for a two-year Associate's degree but that it was not a requirement of the job.

Finally, manufacturers also employ high-skill individuals in positions such as manufacturing engineer, process engineer, or design engineer. Manufacturing engineers assist in

the development of manufacturing methods and processes, analyze and correct tool related manufacturing and operational problems, and work on continuous productivity improvements. Process engineers evaluate current manufacturing processes to identify variables and factors that influence efficiencies and non-conformances. Design engineers use visualization, prototype designs, and consumer testing to translate consumer or customer needs into production ready designs that can be handed off to an internal or external engineering team. All of these engineering positions typically require a bachelor's degree in engineering, strong project management skills, and proactive leadership skills in addition to knowledge of manufacturing. Entry level positions are often recruited out of college and do not need to have prior work experience. However, one large employer reported that they now look for experience through an internship, coop, or research project as part of the hiring process.

Current Skill Requirements: CNC Machinist Position

Eight of the nine firms that we interviewed had a posting for a CNC machinist. For the most part, requirements for machinists were fairly basic with the exception of one firm that was seeking machinists with knowledge and experience on a specific type of machines known as a Swiss-type screw machine. Nearly all of the firms required basic math skills such as trigonometry, basic technical skills such as the ability to read blueprints, and basic computer skills to be able to operate CNC machines including, control functions and programming. Most of the postings also required knowledge of specific materials (e.g. stainless steels, specialty alloys, and plastics) and about half required knowledge of particular processes (e.g. lean manufacturing techniques). Only one firm required particular certifications from either national (NIMS - National Institute for Metalworking Skills) or state (MACWIC – Manufacturing Advancement Center Workforce Innovation Collaborative) industry groups. More than half of

the postings also required organizational skills (the ability to prioritize and execute tasks effectively and quickly), oral communication skills, interpersonal skills (e.g. teamwork and collaboration), and problem solving skills (e.g. critical thinking). One employer described the machinist job as being a “bit of an art” in that workers need to combine both textbook knowledge of programming as well as the experience of how different materials react to being machined.

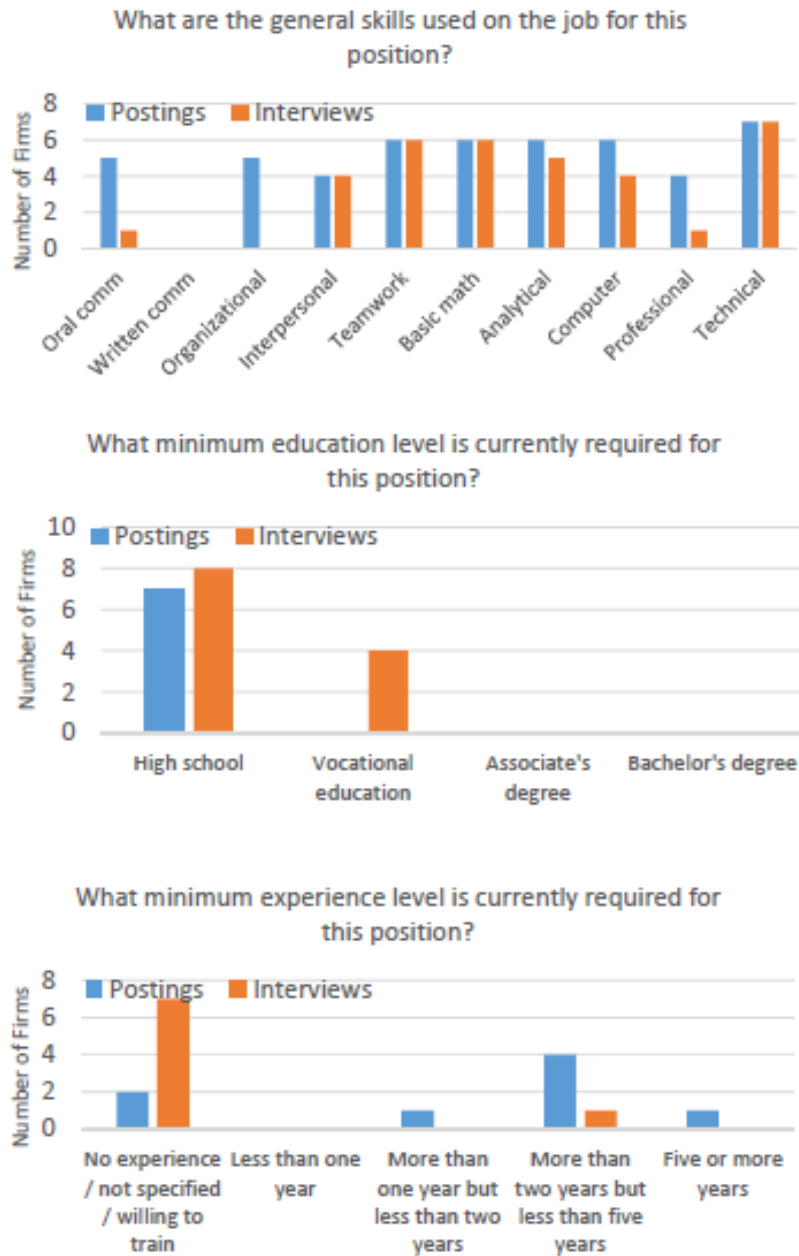
Little was required in terms of formal education, however the need for relevant experience was often specified in the job postings. All firms required candidates for the machinist position to have a high school degree. Although machinists often have received training at a vocational high school or technical school, this was not listed as a requirements on the job posting. In contrast, the amount of experience required for the machinist position varied significantly across the postings we examined. Four of the employers posted machinist jobs that required 2-5 years’ experience, another required “some” experience, and two had no experience requirements listed. Only one employer required five or more years of experience.

To determine whether firms were flexible in terms of their posted job requirements, we compared the skills listed in the postings to those that were identified through our interviews (see Figure 7). Employers demonstrated a consistent need for basic math and technical skills as well as the need for teamwork and interpersonal skills. Somewhat less so for computer and analytical skills. Very few identified a need for oral communication, organizational, and professional skills—despite having listed them as requirements in the job posting for the machinist position.

Although there was little discrepancy between the formal job posting and what interviewees reported in terms of formal educational requirements, the need for experience was starkly different. About half of the employers reported a desire for someone with technical

education but all of those interviewed agreed that the minimum requirement for the job was primarily a high school degree.

Figure 7. What Firms Post versus What Firms Do... Skill Requirements for the CNC Machinist Position



Source: Authors' calculations from job posting and interview data.

Yet regardless of the posted requirements for experience, all but one employer said they were willing to hire candidates who demonstrated some manual, hands-on capability or mechanical aptitude (e.g. “tinkering”) and then provide on-the-job training if there was a sense that they would be a good fit for the company. As one HR Director stated, “As long as they have the mechanical aptitude, we can train them, but they have to have the desire to do that.” Another stated, “A true entry level person is someone who has an aptitude and an interest in mechanically inclined things right. And I talk to people and say; were you the kind of person helping your dad or mom with the car, when you were ten years old in the drive way. Do you like remote control things? Are you a robotics person? You know all those kinds of things, and people who are drawn to those activities, tend to be successful here.” Finally, one employer stated flatly, “Work ethic and gray matter between their ears. If you have those two things, you're golden.” This suggests that, if anything, posted job requirements may be somewhat over-inflated relative to the minimum qualifications for employment.

Changes in Skill Requirements for Machinists Over Time

All firms talked about an increase in the desire for workers that demonstrated flexibility, adaptability, and the ability to continually learn on the job as the technology and processes are continually changing and improving. As one HR Director noted, “I'm not hiring you to do X task. I'm hiring you to be an employee of this company. What I mean by that is I might need you to do all kinds of stuff, right? So you come in, your work is going to change, I guarantee you it's going to change. If I hire the right person, I train you well, you'll be able to learn and grow.” Employers linked this increase in “soft skills” to an industry shift from high volume standardized jobs with long lead times to smaller customized jobs with very quick turnaround times. One employer reported shifting to a team environment with a flatter structure so that workers could

manage multiple jobs/machines simultaneously and pass off jobs across shifts. As one HR Director noted, “Years ago, when we talked about teamwork, we weren't really living and breathing it to the degree that we are today.” In addition, employers emphasized overall “employability” as essential such as having a positive attitude, a willingness to learn, a strong work ethic, and the ability to follow directions and abide by safety rules.

Some employers also reported a shift toward requiring greater problem solving skills due to increased automation and robotics. The increasing use of technology in manufacturing has led to many routine tasks being automated so that workers now need additional skills for more customized jobs. One employer explained, “So we used to have a lot of high volume jobs so there would less need for somebody to be adaptable and flexible and you know fast paced... Smaller jobs, quicker slots; lots of those kinds of skills they have to be a lot more adaptable and flexible, more time conscious.”

Another described it as an increase on the level of sophistication needed for existing skill sets rather than adding entirely new skills to the job. “So uh that is why the requirement for the machinist has changed because the parts are more complex. They have to understand more about programming they have to understand more about the machine than they did in the past.”

In addition, employers noted that more on-the-job training is now required on a continual basis because the technology is changing so rapidly that customers are requiring ever more complex parts to be manufactured. One employer discussed increasing skill requirements over past few years to get better qualified people. “In the past they were button pushers now we need more skills to produce higher quality so they can compete for the higher-end [customer] jobs.” Unlike other industries, this increasing need for more analytical and interpersonal skills has manifested largely in terms of the quantity and quality of the experience that employers were

looking for in a candidate rather than raising education requirements. This makes sense given that the education requirements were quite low to start with and so much of the work involves a hands-on knowledge of how to work with machinery and materials.

However, experienced candidates are less not as easy to come by since the end of the Great Recession. The firms we talked to indicated that it was easier to find experienced machinists during the recession because they received a greater number of qualified or even over-qualified applicants. During the recession the position typically took only weeks to fill compared to current labor market conditions under which it takes several months or more. Three employers report that they are always hiring for this position. There was definitely a sense that they could recruit a better candidate during the weak economy. One firm reported hiring workers from other local companies that were going out of business. Another reported poaching candidates from smaller firms but has since “exhausted the local talent pool” and need to find a new pipeline. One firm reported trying to attract candidates from out-of-state (e.g. PA or Midwest) but reported that the high cost of housing in Massachusetts makes it difficult to recruit workers from places where the labor market is not as strong.

Since the end of the Great Recession, manufacturing employers report that they see the same number of candidates but that the quality of the candidates has decreased. When asked which requirements would they would lower if they could not fill the position, manufacturers appeared quite willing to downskill if needed. All but one firm reported that they would reduce the years of experience required while the remaining firm said it would lower its education requirements. In fact, three of the nine employers we interviewed reported requiring 5 or more years of experience during the Great Recession compared to the 2-5 years that they currently list in their posting. Of those, one HR Director noted, “when we first posted that job in 2016, the

minimum experience requirement was three years. We since have shifted that to one year on-the-job work experience we're looking for. And I think the reason we felt comfortable doing that was because we have a technical interview component, so we were really able to kind of vet that in the interview process.”

Overall, it appears that manufacturing employers may have been able to strategically hire more experienced workers during the Great Recession to address the structural pressures associated with increased competition from globalization. Although the shift in manufacturing away from mass production and towards precision, customizable, and high-quality products had been unfolding since the 1990s, it wasn't until firms were faced with a glut of experienced candidates that manufacturing firms changed their hiring requirements. Indeed, this behavior supports the trends described by Jamovich and Siu (2013) where recent recessions have been characterized as a catalyst for labor market changes, particularly in the middle of the skills distribution.

Responses to Current Labor Market Conditions

Raising Wages

When asked about the types of actions they have considered taking given the difficulty in recruiting experienced workers in the currently tight labor market, there was not much enthusiasm for raising wages. Small and mid-size firms said they could not raise wages because of competitive pressures that have led to contracts being decided on fractions of a penny per piece. Others indicated that the raises in the state minimum wage over the past several years left little room to raise wages even further. One employer characterized his recent experience recruiting for a skilled machinist as wanting a “wonder person to do everything” but having to stay within his budget, and so he wrote the ad such that he could find willing candidates. This

type of behavior suggests that while employers may have been opportunistic in selecting more experienced workers during the Great Recession, they are more willing to accept less experienced applicants now that the labor market has tightened.

Training

Since the labor market has recovered, both small and mid-sized firms talked about the difficulty of hiring skilled workers who had both the knowledge and hands-on experience to work on the expensive and highly customized machinery used to produce their products. Some machinists receive relevant training and work experience through an internship or coop position that may lead to a full-time job. One employer mentioned hiring adult students from the E-Team, a grant funded machinist training program on the north shore of Boston that teaches basic machining and manufacturing techniques, from professionalism to "hands on" machining in the evenings at a local vocational high school. Yet these programs seem few and far between and not very well connected to the web of small and mid-sized employers that could benefit the most from them.

Despite the conventional wisdom, the manufacturers we talked to were quite willing to train new workers as the labor market tightened and more experienced workers were harder to come by. Although employers still looked for some mechanical aptitude and an interest in machining, firms were willing to train workers if they had the right motivation and would be a good fit for the company and for the shop floor culture. According to one CEO, "So people who are trustworthy, who are reliable, who are going to show up, who are going to work hard and who are going to ask questions, who are always going to go above and beyond. So they may not have done in to this day to day job but if those are the kind of people that they are then we can train."

Indeed, the employers that we talked to were actively engaged in training new and incumbent workers if they lacked the skills needed for the job. In the past, several employers indicated that they had previously hired more experienced workers who left the larger manufacturing firms where they had been put through a formal apprenticeship program. However, over the past decade, these large manufacturers have eliminated their apprenticeship programs as competitive pressures have made it too costly to provide such large training programs when manufacturers are hiring fewer workers.

Indeed, according to the Labor Department, formal programs that combine on-the-job learning with mentorships and classroom education fell 40 percent in the U.S. between 2003 and 2013. As one owner of a small firm noted, “Years ago the larger companies had apprenticeships. My dad went through the Boston Gear apprenticeship and went to engineering school. General Electric had a wonderful apprenticeship program. Gillette had a program. Most of those are gone now.” On the other end of the spectrum, the HR Director at a large firm acknowledged “we're not in the training business” when discussing the end of their formal apprenticeship program and talked about the desire to leverage existing educational institutions to provide basic training.

In response to this drop-off in the supply of experienced workers from larger firms with formal apprenticeship programs, half of the employers that we talked to had made use of a state funded program called the Workforce Training Grant. The grant provides firms with funding to send employees to training programs or to develop in-house training where trade school students and young workers can learn from experienced mentors to gain skills such as lean manufacturing and other advanced manufacturing techniques.

To be eligible for the grant, employers are required to demonstrate the need for the training, the positive impact the training would have on the organization, and the company's fiscal responsibility. For example, one firm sent 32 employees to a training program provided by the Massachusetts Manufacturing Extension Partnership (MMEP) to learn problem solving skills and lean manufacturing techniques that would improve their ability to quickly respond to customer needs. Another employer was part of a larger group of manufacturers that worked with the South Shore Workforce Investment Board to provide training to their incumbent employees through MMEP for basic manufacturing knowledge in specific topic areas. Two other firms that we talked to had received four such grants over the past ten years that provided worker training in math and trigonometry, all types of lean training (such as 5S and setup reduction), English as a Second Language (ESL) training, supervisory skills, and technical development training. As a result of the training, these firms reported improving processes such as scheduling, planning, tooling, and production. One CEO said in a related news article that "While our employees do a great job of picking up their skills on the job, with this grant, we can expedite the process and out more seasoned personnel on the floor every day." Two other companies cited the training provided by the grant as a key factor in growing and retaining their staff as they remain productive and competitive within the advanced manufacturing industry.

Many firms also noted that the difficulty they were experiencing in hiring more experienced workers was likely to worsen as the Baby Boom generation retired. This is because of the difficulty in attracting younger workers to the manufacturing industry as many youth and their parents view such jobs as "dirty" and a "dead-end." In response, one of the firms that we interviewed had recently established a formal, accredited training center that combines online, computer-based techniques and actual work experience on appropriate metalworking machinery.

The center focuses on preparing workers specifically for manufacturing jobs with high vacancy rates throughout the state and graduates a new class of 7-10 students every eight weeks. Several of the smaller and mid-sized firms that we interviewed had either recruited workers from this training center or sent their incumbent workers to receive training there.

Recruiting Practices

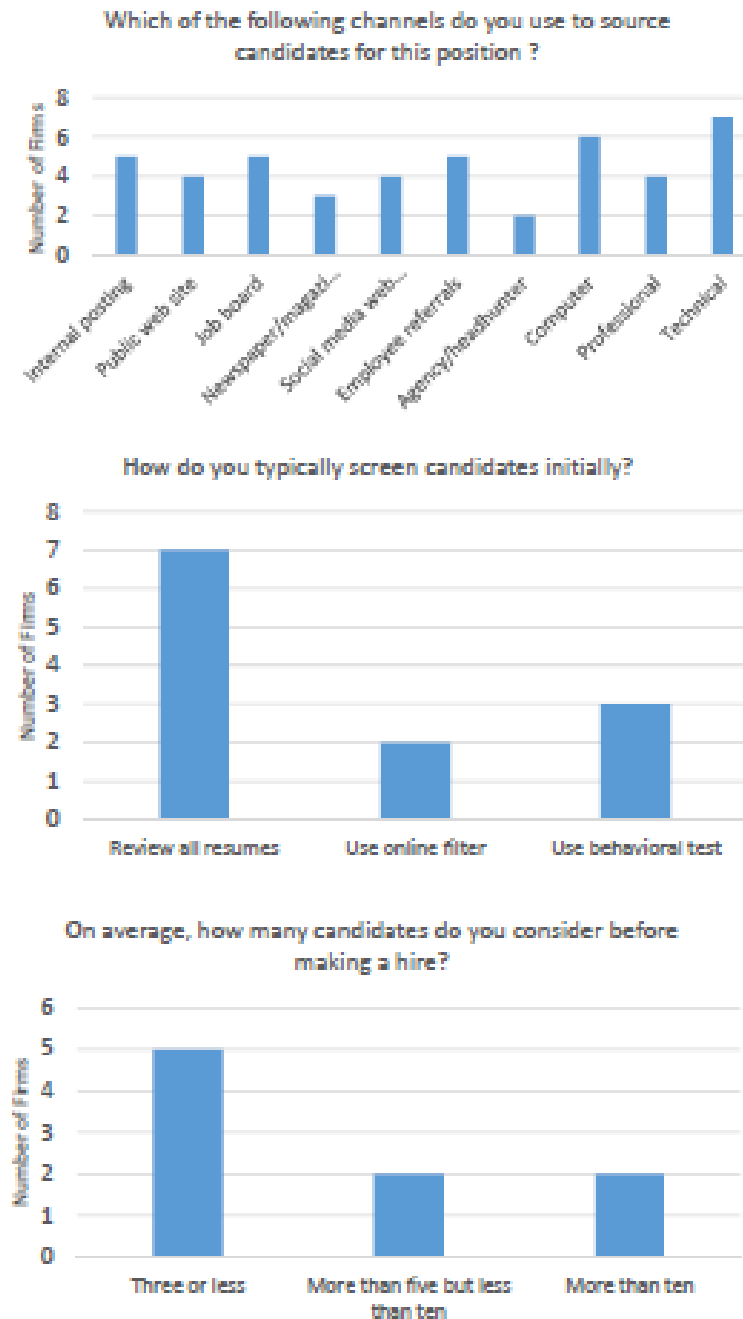
Manufacturing firms seem to recruit from a wide variety of sources to be able to source candidates with the right qualifications. At least half of the employers we interviewed reported posting job ads internally, on the firm's public web site, on a job board (particularly Craigslist), and on social media (see Figure 8). Only two firms reported using a temp agency or headhunter. By far the most popular source of good candidates was from employee referrals.

With the exception of the largest firms, most employers review all the resumes that they receive and do not use an online filter or behavioral testing. Most firms narrow their pool of candidates down to just three, but a few of the larger firms will interview ten or more candidates. These days, the employers we interviewed indicated that although they still receive roughly the same number of resumes and job applications, many of these are from individuals who are either grossly underqualified with no mechanical aptitude or interest or grossly overqualified with engineering degrees.

All of the employers we talked to expressed some concern about finding workers as the labor market continues to tighten and replacing older workers as they retire. Despite these concerns, none of the interviewees had developed a consistent pipeline or relationship with any of the vocational technical high schools or community colleges. We heard repeatedly that the voc techs and community colleges were not the best source because they lacked up-to-date equipment and experienced instructors to provide hands-on instruction. In addition, more than

one interviewee expressed frustration with a shift away from manufacturing and towards less “dirty” jobs among both voc tech and community college students.

Figure 8. Recruiting Practices for the CNC Machinist Position



Source: Authors’ calculations from job posting and interview data.

Conclusion

Manufacturing in the U.S. is now leaner and more competitive due to globalization. As a result, manufacturers are looking for workers that can adapt and change to whatever they need in the moment. They look for tinkers with some degree of mechanical ability and knowledge of basic math skills such as trigonometry and measurement of angles. After that, they look for workers who want to learn, who are willing to train and retrain, and who will take the initiative to become more efficient. In manufacturing this means learning to program and operate new machines and to keep several machines running smoothly at once. It also means learning new production processes to work in teams to keep multiple jobs running across worker shifts. And finally, it means learning to manufacture items with greater precision or with more intricate detail or out of different materials.

Despite the increased need for deeper skill-sets, many of the employers we talked to pointed out that none of these skills are new job requirements—just more sophisticated or higher-level. Contrary to recent news articles, none of the employers we talked to had increased their education requirements. As one employer put it “Formal education is not a substitute for vocational training.” This suggests that the “college for all” mentality is not as prevalent among the manufacturing industry as anecdotes suggest.

Moreover, increases in other formal job qualifications posted by manufacturers during the Great Recession, such as years of experience, were not permanent shifts in response to secular forces. Rather, postings that listed five or more years of experience reflected an effort to recruit the best possible candidate when workers were plentiful and these requirements have receded as the labor market has improved. In addition, all of the manufacturers we talked to were willing to hire workers with no experience and train them—as long as they had the right initiative and soft

skills to be continual learners—regardless of the formal experience requirements that were listed in the job posting.

Rather, manufacturing industry leaders assert that the type of advanced training program we need for manufacturing is an apprentice program, similar to training programs in Germany and Switzerland. An apprentice typically learns foundational skills that cover any field of manufacturing, whether it is as a pipe fitter, machinist, electrician, assembler or maintenance worker. In addition, employers pay the workers while they are in training and provides a full-time job upon graduation.

Given that many of the employers we talked to are already engaged in some form of training, it seems that manufacturing would be a natural fit for expanding the federal apprenticeship program. In December of 2014, the Department of Labor announced a \$100 million grant competition to grow the number of apprenticeships offered in the U.S.—the largest-ever such federal investment. Unlike prior efforts to promote general training via legislation like the Workforce Investment Act, apprenticeship programs focus on high skill training specific to manufacturing and other industries. Dubbed the “other four-year degree” by former labor secretary Thomas Perez, the average starting salary of an apprenticeship graduate is \$50,000 and many graduates can transfer the skills they learned on the job into college credit—meaning they can still complete an associate or bachelor’s degree, but at far less cost.

Aside from apprenticeship programs, other career technical education (CTE) programs in high schools, community colleges, and vocational schools are experiencing something of a resurgence. In recent years, a significant number of states have developed and implemented new policies and programs to advance CTE at secondary and postsecondary levels. Nearly every state

had CTE-related activity: state legislatures and regulatory bodies approved approximately 150 policies across 46 states and the District of Columbia.

Yet industry leaders say that it is difficult to attract younger workers to an industry that was once considered “dying” and “dirty” especially as the focus in U.S. high schools has shifted towards college preparation, discouraging better-skilled students from gaining the needed credentials to enter manufacturing. In a poll conducted by the Foundation of Fabricators & Manufacturers Association, roughly half of all teenagers said they have no interest in a manufacturing career and of those, the majority agreed that a manufacturing career entailed a “dirty, dangerous place that requires little thinking or skill from its workers and offers minimal opportunity for personal growth or career advancement.” In addition, NMI and Deloitte’s most recent study of U.S. public opinions on manufacturing, respondents aged 19-33 ranked manufacturing as their least preferred career and only a third indicated they would encourage their children to pursue a career in manufacturing. Until perceptions of the industry change, manufacturers will continue to face challenges recruiting new workers to the field.

B. Finance

The finance industry (here using the North American Industry Classification for “Finance and Insurance”) is a major contributor to GDP and employment. While there has been some growth in the share of GDP accounted for by finance in the past few decades, the share of total employment in this industry has been roughly stable at 4.5%.

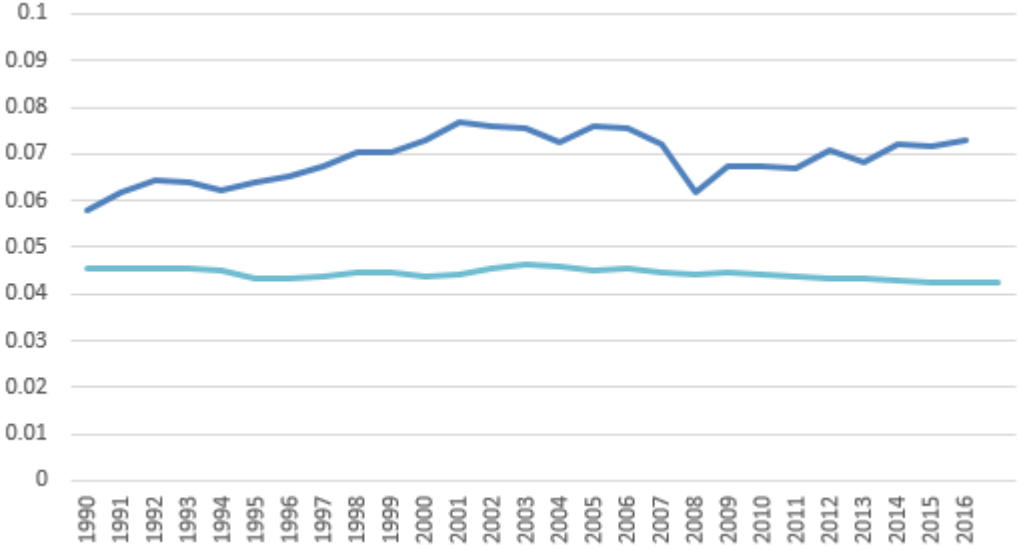
Industry Overview

The finance industry covers a wide range of firms, from banking and insurance companies to investment services companies. The main subsectors include central banking, traditional

banking/credit, securities and investments, insurance, and financial funds. The largest two subsectors are traditional banking and insurance, which have roughly equal employment.

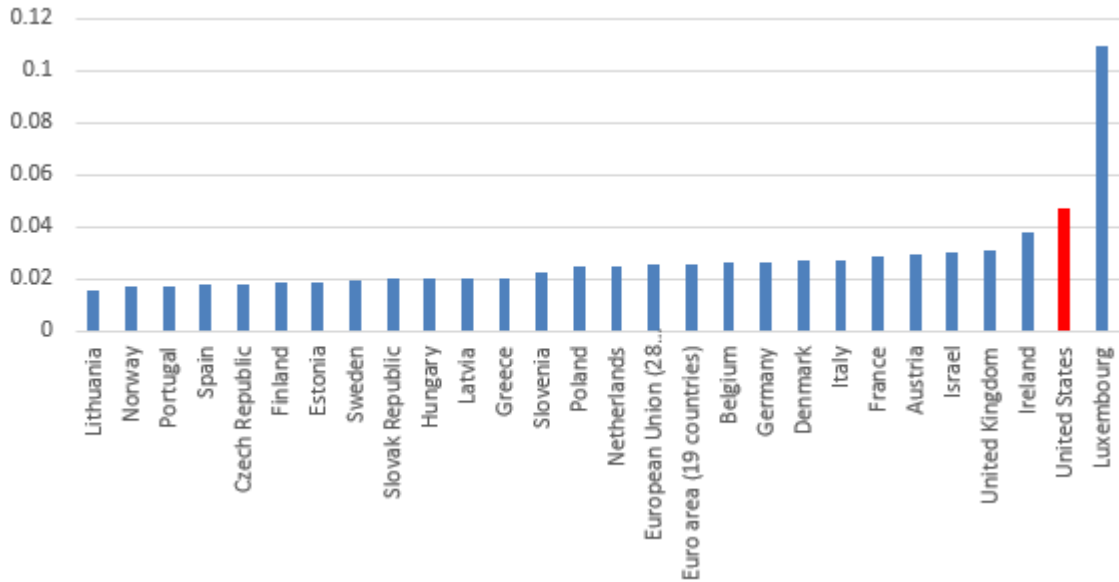
The industry had grown in absolute terms relatively continuous from 1990 to 2008, at which point it experienced a loss of a roughly 10% decline in total employment nationwide. The industry has only just now (in 2017) recovered the employment totals it had before the Great Recession.

Figure 9. Employment Share in Finance over Time



The finance industry accounts for a larger share of employment in the United States than in most other developed countries. Amongst the OECD, only Luxembourg had a higher share of total employment in that industry in 2017.

Figure 10. Share of Employment in Finance



The largest occupations in the industry in the United States are tellers, securities and financial services agents, loan officers, insurance sales agents, and accountants. There is a wide range of salaries across these occupations, with tellers earning roughly \$28,000 a year on average and financial services agents earning over \$100,000.

Compensation growth in the industry has remained relatively stable at roughly 2.5% since 2004 (with the exception of a slow 2009Q1). This is a slower pace than experiences at the beginning of the 2000s, when compensation in this industry was rising very quickly (averaging over 5% annual growth).

Financial sector jobs accounted for roughly 9% of the total job postings in June, 2016. The most prevalent occupations were again sales, tellers, customer services, financial analysts, and computer occupations. The firms posting the most advertisements were American Express, Ameriplan, Bank of America, Berkshire Hathaway, JP Morgan Chase, and Wells Fargo.

Financial sector jobs postings are concentrated in the New York metro area. Chicago, Los Angeles, and San-Francisco follow far behind.

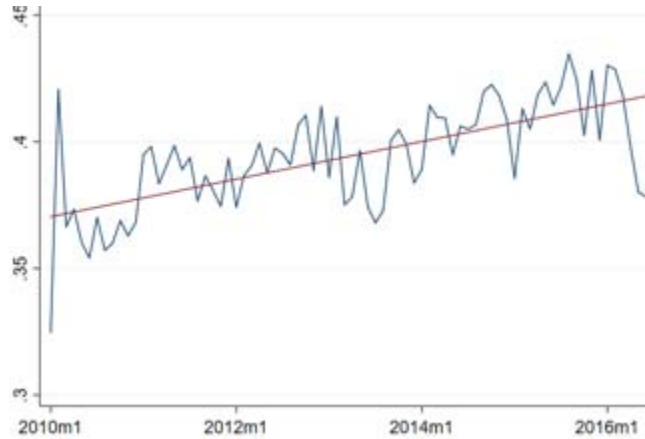
The EEOC collects data on the demographics of employment for employers with more than 100 employees. The EEOC splits their data by rough occupation categories, with the categories “Clerical”, “Professionals”, and “Officials and Managers” accounting for nearly all of the employment in the financial sector. Women hold between 33.8 (in the securities subdivision) and 48.6% (in the banking subdivision) of the officials and management employment in this industry. This largely reflects employment by white women, with Black and Hispanic women comprising shares ranging from 1.6% to 4.5% across subsectors. Overall “official and management” employment for minorities is very low in this sector, with Black and Hispanic shares ranging from 2.9% to 7.0% across the two groups and subsectors. This lack of diversity is not present in the “Professionals” occupation category.

Middle Skill Jobs in Finance

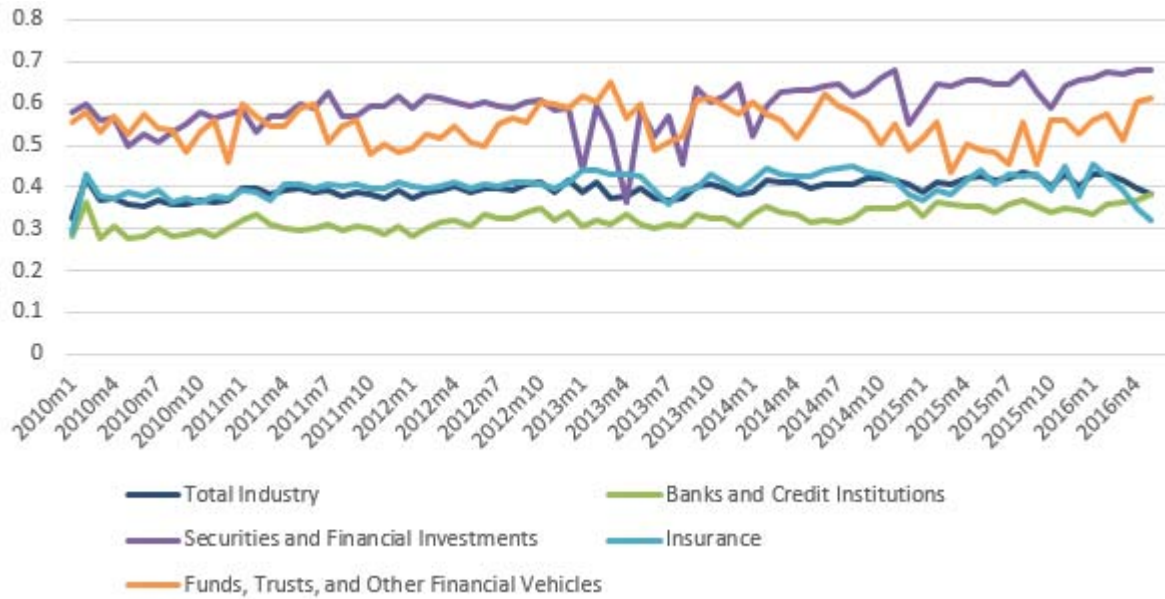
To study middle skilled jobs in finance, we interviewed several recruitment firms about their placements in entry level positions. The middle skill financial sector jobs we were able to reach tend to demand more education than the positions we were able to survey in other sectors. The most common job discussed ranged from accounting positions, to more technical computer programming positions, to call center and other lower skilled jobs. Most of the employers were looking for applicants with a college degree, though the experience requirements ranged widely. This mimics trends seen in the job posting data from Burning/Glass. Among jobs in securities and investment vehicles, a clear majority of postings explicitly require a college degree. Given that Burning/Glass doubtlessly undercounts this requirement, this suggests that formal education at the undergraduate level is generally expected.

Even in the insurance and commercial banking subsectors, where these degrees are less common, bachelor's degrees are increasingly requested. As a result, there has been a steady increase in this requirement over time across the industry.

Figure 11. Share of Job Postings Requiring a Bachelor's degree or Higher in Finance



By Sub-Sector within Finance



Source: Author's calculations based on data provided by Burning Glass Technologies

Education is a crude measure, however, of the skills requested by employers. The Burning-Glass data, while detailed, cannot capture all of the ways in which skill requirements have changed, how applicant pools and hiring practices have responded, and what skills will be demanded in the future. To study this, we interviewed several employers and human resources professionals in the finance industry.

Changes in Skills Required

We asked respondents about whether they had observed changes in the demand for skills and how these changes were related to the pool of available applicants.

Several respondents did mention significant changes in employer demands in response to changes in the skills demanded of applicants.

For example, one respondent noted that “the expectations with regard to education had changed.” She said, “when I started in recruitment, a bachelors degree was an acceptable qualification.” That recruiter said that now she was more likely to place candidates with post-graduate or even doctoral level candidates in those roles.

Similarly, several recruiters have noted that employer demands are more specific than in the past. “I used to be told, bring me your best player,” said one recruiter, “but now I’m told bring me a candidate with A, B, C, D, E (skills)”.

This up-skilling occurs even in very high level jobs. One recruiter said, “We’ve started recruiting graduate students only in the past few years... we initially had very low hit rates, but the ones who responded, were very high quality.” Yet another said, “When I first started.... People had MBAs. Now an MBA is only required in a very limited set of jobs... now it’s a PhD. What’s next?”

This expression was not universal, however. A recruiter for actuarial positions noted that “there is a [regulatory] requirement that you have a certain number of [certified] actuaries on staff to underwrite insurance... [Our requirements] are really not flexible or changing.”

Reasons Offered for Changing Skill Requirements

Four central explanations were offered for changing requirement.

Changing Job Roles

The first was changes to the jobs themselves. One recruiter noted that finance jobs now require significantly more computer and mathematical skills than in the past. She attributed changing employer demands partially to this evolution in roles. “As the types of technology used in the financial sector have become more advanced and more detailed, the demands for more specialized skills have increased.” This respondent also said, “The demands have changed, because the technology has changed, the needs have changed of the client base.” Another employee at a major bank said, when discussing his current recruiting goals, “It's changed a lot in that there's a lot of these kinds of jobs that are popping up that probably didn't exist just a few years ago.”

Some respondents described entirely new fields. “Even just three or four years ago, our firm did not at all have the posture that it does today when it comes to cyber security... It's changed a lot in that there's a lot of these kinds of jobs that are popping up that probably didn't exist just a few years ago. We've got completely new jobs that didn't exist before. We need skillsets that probably weren't really heard of before, and just creating a whole new kind of career path, certainly within our firm. I would imagine you're going to find similar things at other large banks as well.”

These sentiments were echoed by a recruiter for accounting and technology positions. They noted that regulatory changes – like Dodd-Frank – had changed the duties for several entry level jobs. The recruiter noted that even when existing jobs were not changed, regulation creates new jobs at the same level – like a compliance department -- that changed average skill levels. “They have had to hire a whole new function of people...they are taking people who were doing all types of roles and are now having them do more regulatory role.” Similarly, another respondent said “the regulatory environment has changed dramatically in the last five to ten years. Asset managers and banks are expected to comply with certain regulations and those regulations demand certain types of technology to address the regulations. It could be as simple as the Dodd-Frank ruling. They need to comply to the Dodd-Frank ruling, and part of that is having the right technologies in place to audit or to manage data. The types of programs or the types of technologies that are now available to do that are more complex and they're more in demand. The needs of these financial sector employers have changed as a result.”

Another mentioned an increase in the demand for new types of skills. “Jobs ask you to multitask more. There are more distractions at work that require you to be able to deal with the environments – the Facebook, the snap-chats”. The recruiter said that in response employers were placing greater emphasis on resumes that signaled focus.

Others mentioned the need for more quantitative skills – both in more experienced computer science positions – and even in customer service positions. “I think it’s important for customer service and human resource positions to focus on data analytics,” said one recruiter, who explained that people who could understand and use data reports could greatly improve the efficiency of those positions. “Today, on a general basis, we know some of the information [in the data], but not at the detail I’d like to see,” he said, “and I think the industry is going.”

Also in that vein, one respondent suggested that the complexity of the industry necessitated more specialized skills. She said: “The story here is that there's a great difference between a technology generalist and the technology specialist.... Now, when somebody will graduate, even from a PhD, they will come out with a baseline of skills of technologies that they've learned. They may have gone to a school that's delivered a computer science program in the Microsoft stack. They will come out as a full Microsoft stack developer, but until they get their first job, they won't have applied that skillset in a specialized way. For example, for an order management system for an asset manager, once they've had that specific experience, then the demand increases and they become a more desirable candidate. It is then independent of their education. The education is the foundation, but their specialization is the thing that makes them desirable in the end.”

Changing Applicant Pools

A second explanation for changing requirements was changing supply in the number of applicant. One recruiter noted that there were far more international candidates for these roles, and that these applicants forced native applicants to pursue more education and compete. This recruiter claimed that competition from applicants migrating from Asia and Europe had “undermined the bachelors degree as an entry point” among her placements.

Conversely, recruiters noted that they were able to place stronger applicants in jobs when the labor market was slack. “The placements we were able to make in 2009 we fantastic, fantastic people,” said one recruiter, contrasting to more recent years. Another said, “I remember [during the recession], the Big 4 laid off thousands of people.... I couldn't buy a job for those people. You had to walk on water to get a job... you had to be in the top 10% in school and in your Big 4 ratings... now, it's so hard to find people all those requirements are gone.”

Alternatively, we were told, “the managers have to be much more flexible now because there’s less talent available.” Another respondent echoed “when 2008 hit, we had fewer positions to fill, we weren’t writing as many policies, and so we could be more selective.”

“It was very easy to get top candidates from top schools in 2008, 2010, even 2011 – but as unemployment decreased, recruiting [for our unattractive positions] has become really hard.”

Changing Economic Situations

Several respondents noted that the industry’s profitability was a strong determinant of the demand for skills. One recruiter said, “In 2006, 2007 a fund would say bring me the best person you could find and they’d hire anyone....Today, the market has become very specific very focused.”

Changing Firm Culture

Many recruiters cited changes in firm culture that led to more demands for skill. This could stem from several sources. Some cited firms pursuing a “flight to quality”, wherein they want to make long term investments in having skilled employees beyond what is needed. One recruiter said the very best firms are willing to offer “a lot of perks” to ensure they snagged the very best applicant. In the words of another recruiter “They want the elite, regardless of what else is in the market, and they are willing to pay top dollar for it.” Another said, “If we were a lower tier firm... I think that we would have to compromise our standards. We are able to attract top candidates regardless of the environment.” Some attribute this to learning. “It’s not like the demands of the role have led us to demand a greater skill level... it’s just us realizing that there’s more to be gained from those with more academic experience.”

Shortages

Many employers stated that there were times when they had difficulty finding qualified workers. A common refrain was that applicants did not possess the new skills that were being demanded. For example, one employer said, “there’s more demand for data analytics and informatics, and there are not enough people graduating from school.” Similarly, we were told, “when you’re dealing with actuarial positions, you are not going to have a lot of applicants. You’ll have, say, only five or six.” Similarly we were told, “There was a challenge to find actuaries... there weren’t enough actuaries. There were not enough and we couldn’t write business.”

Some employers tied this shortage to the business cycle as has been discussed above. One person said, “There was definitely a shortage of applicants in 2005 and in 2014 – pre-recession and post-recession”, and another, “in 2008, it was easier to find talent.” Another noted, “before 2014, it was an employers’ market and we could pick and choose our candidate. Now we’re back to a candidates market where they have many more opportunities and it’s much more difficult to find the right person. That’s across the board, actuarial, accounting, finance.... It’s really difficult.” Other respondents were more succinct; saying “the shortage of qualified workers is getting worse.”

Many felt that this was especially true for highly in-demand skills. For example, we were told that “big data...was considered one of the best, highest paying jobs you could find, was for a big data scientists. They're still very hard to get.” Similarly, some discussed shortages in terms of education rather than occupations. A recruiter who staffed call centers and customer facing jobs noted that post-Recession “we don’t see as many recent grads that are looking for true entry level like call center customer service type jobs.”

We should note that this opinion was not universal. One respondent felt that the Recession actually reduced the number of applicants for highly skilled positions, as qualified applicants with existing jobs became less willing to switch employers. “During the recession we had less applicants. By nature, people are risk averse. They didn’t want to change jobs... People who were willing to move were probably not the top talent.”

Coping with Shortages

Employers discussed various strategies for coping with shortages of qualified workers.

Extending Vacancies

One common refrain, which is consistent with other macroeconomic data, is that firms left positions vacant for longer. For example, one responded said, “we can’t fill an analyst position...it requires experience and it’s been open since May.” Some respondents felt that this strategy was more common now than in tight labor markets before the Recession. She said, “pre-Recession, money was not object [in terms of raising wage].... I could throw money at people. Post-Recession it hasn’t gone back to the way it was. We tend not to throw money at people and just leave the position vacant longer.” Another said that now, “I can’t pay you a premium if you have no work experience”

Another employer suggested that extending vacancies was the preferred approach. “I would say that the first inclination is to wait. These jobs can stay open longer than they probably should. The second inclination is to start going down the route of “as long as he or she seems like they have potential, we can train them." That's kind of the second route to go. Neither one of those are really great options, but they do happen.”

Hiring non-local workers

Another common solution employers mentioned to perceived worker shortages was to recruit from abroad or from other regions in the US. For example, one recruiter said, “[i]f we’re not looking to hire foreign workers, we are not going to be able to fill these positions. There are just not enough qualified US people to do it... and that’s not going to change any time soon.” Reflecting on her experience, she noted that for skilled actuarial positions, “if I had 5 applicants, three would be Chinese and maybe two would be American.”

Some expressed concern about the viability of this approach going forward, given the political climate. “For mathematics, science, and engineering is really India and China today. As the visa system changes, what are we going to do as employers... and we haven’t figured that out yet. Another said, speaking of the years prior to the Great Recession, “it was eas[ier] at that time to get an H1-B visa,”

Some employers mentioned trying to move positions to less competitive and expensive locations within the US. A human resources professional mentioned that in their firm, “there’s just a lot less jobs that are going to be in the most desirable places to live because they’re too expensive.” Similarly, a third recruiter noted, “in Boston, people have to be flexible to somebody who wants to be in Boston. If you’re hiring at the senior end, of portfolio manager or chief investment officer or something, the pool that you’re fishing from probably isn’t local. Then, you’re trying to attract candidates, for example, from New York. There’s only so many people who actually want to move to Boston.”

Training

Some employers respond to shortages by expanding their training programs. After discussing a skilled worker shortage, one respondent told us that they would “hire a more junior person and train them up. Or, look at hiring out of the sector.” They noted that there was

increasing willingness to tolerate this type of training, saying, "it used to be you would have a premium for working in the financial sector, so you would need to hire somebody that understood X, Y, and Z about equities, or fixed income, or whatever it may be. Now, pretty much technology is technology. They'll hire somebody from the pharmaceutical sector, or they'll hire somebody from high tech, or they'll hire somebody from a random startup in the commercial sector. Because, the financial sector still pays a slight premium, but you don't necessarily have to have that experience. That's the other route" Another said they "could find a fresh grad...but they don't have any practical work experience...it's a different skill level. Sometimes we have to settle and take that fresh grad and train them. It's very difficult to do that."

One avenue for finding workers to train was to look internally. An HR professional said that in response to shortages, "we did a lot of internal hiring because we couldn't find the talent, so we'd move people around to cover that gap."

Part-Time Employment

The last common response we heard from respondents dealing with a shortage of qualified workers was a willingness to provide part time and other flexible arrangements. We were told, "We used to hire only full time people, and that was it. If the business ever had fluctuation in volume we'd hire temps who weren't on our payroll. Now we are focusing on part-time employees. What that enables us to do is to open our channels – like working moms or retirees who don't want a full time job. This has changed the types of people we look for." Respondents using this type of approach noted that it opened the door for new types of applicants. "Sometimes we see an uptick in people at the tail end of their career looking for something more flexible," one said.

Another mentioned that, prior to this arrangement, it was difficult to staff at certain times of the year. “At the end of the year, people are reluctant to leave their old jobs because they are close to receiving their bonuses.” This issue was solved by opening up part time spots, because “part time people don’t have to worry about this, and so it’s made it easier for us to staff needs at the end of the year.”

While there were some additional response, for example increasingly using headhunters, the four categories mentioned above were the most prevalent.

Changes in the Hiring Process

Applicant Friendly

We also prompted our survey respondents to discuss changes in the hiring process. Here the responses were more uniform. Virtually every respondent stressed the increasing need to make the hiring process more applicant friendly. One respondent said, “Now, there's been a slight change where clients are actually having to sell themselves to the candidates because the candidates have a choice of where they go, too. That's for the best candidates, not just for any candidates. Clients are much more prepared to sell themselves than they ever were before.”

Another felt that, “more so then ever, it’s really important to focus on the candidate experience... for example, If it takes more than three clicks to get to where they apply for a job, they might give up. So we need to be very mindful of that.”

Respondents felt that negative experiences with the hiring process might create lasting reputational damage to the firm. One HR professional described a situation in which a colleague asked off-ball, “cute”, and irrelevant questions in an interview. The respondent was still angry about the incident that left a sour taste in the applicant’s mouth and raised potentially legally inappropriate interview topics. Another respondent elaborated on the potential reputational costs

of difficult processes. “People might work there, but they also might not refer their friends to work there. They might even decide not to be a customer or to tell their friends not to be.”

Pro-Active

A second common theme was the need to be pro-active in recruiting. One person said, “We need to build pipelines of candidates, to have a list ready.... when an opening arrives, I already have a identified the people and had a conversation with them. That’s sort of the agency model of recruiting, and corporate hiring is definitely evolving to be more like that.” This mirrored sentiments from an earlier interview, in which another respondent said, “you're constantly building up your inventory, and that's what we call it, inventory of people that are good.”

Others said, “We need to get into a position where we’re building pipelines of talent and where we are staying in touch with that talent.” And we were also told, “I would rather have my time spent networking and looking on linked in and identifying people that way. Not the people who were necessarily looking for jobs, but the people who were happy where they were but willing to entertain new opportunities.”

Some respondents mentioned dissatisfaction with the ‘older’ more passive approach to recruiting. The surveyor was told, “We tend to get resumes that are not really what we are looking for. Generally, most of the time that we ... This is speaking from my own experience. Most of the people we ended up hiring, we hired because somebody knew someone who was good for the role. They had all the right qualifications, but we were never going to find those people with those right resumes going the traditional route....It's a lot of word of mouth. It really is. That is what has worked the best for us. In myself, in particular, out of deep frustration with

the HR process as well, even just not this summer past, but the one before it, I went and recruited an intern.”

Transparent

A third common message was an increasing desire to be transparent with applicants to ensure a good match. One employer said, “As a candidate you are interviewing us just as much as we are interviewing you. It needs to be a fit on both sides.” They followed up on that sentiment saying, “I am not trying to sell you on an opportunity, because I need for you to stay. Retention is important to me.” Similarly, another respondent said, “if that job is a dead-end role and there is no appreciation, advancement, and opportunity, I think those folks, this is my own theory, we can prove this out or get me some grant money and we’ll figure it out together: those folks leave sooner.”

Automated

The final trend mentioned is a bit of a departure from the ones mentioned above, and it was most discussed by respondents staffing lower skilled positions. We were told that, “there are periods of time...when there are more people looking for roles, it would be extremely important for us to work smarter not harder. We really need to make sure the job description is clear and precise in terms of what we’re looking for.” Similarly, we heard that, “frankly people apply to things that aren’t even close sometimes.”

In response to this, respondents mentioned using pre-screening questions to prioritize applications. These questions – which might be simply clicking a box or selecting an answer from a dropdown bar, were designed to gauge an applicant’s familiarity with the industry. “It becomes important for us to ensure that pre-screening questions are set up so that... if we have

150 resumes come in I have a way to prioritize them. Otherwise it's just shuffling paper. The pre-screening mechanism gives us a scoring mechanism for making that first call....You could get hundreds of people to apply. It's extremely difficult when staring at hundreds of resumes to figure out where you are going to start.”

While the impetus behind these questions may have been to limit the pool, the respondent did not feel that the use of these tools would diminish as the labor market tightened. That was because, the respondent explained, these questions were not used to determine whether or not an applicant would be hired but rather to prioritize the list of applicants. “The roll of pre-screening will be the same whether we are in a recession and hundreds of people apply or the market is tight and we have less people apply. The intent is so that a recruiter can prioritize.”

Though the respondent felt that these tools would become increasingly common, they did note that they were limited. After touting the importance of personal skills, the respondent noted that these were particularly difficult to test in this way. “If I asked you what products you are familiar with, that's something that's easy to pre-screen. But if I ask you how you treat customers, that's something that's very hard to pre-screen. That's something we're trying to figure out how to do.”

Skills for the Future

Our last topic of discussion generally centered on desirable skills for the future. Here too there was a surprisingly common set of answers across respondents. Many of our interviewees stressed the importance of applicants who could combine social, verbal, and leadership skills with technical expertise. A recruiter for actuaries said, “In the old days you were just a super smart dorky math person who knew how to use a slide rule to do math, to now you need to have communication skills and business acumen, and you really have a seat at the table....In the old

days, you couldn't communicate well. Today the expectation is that you have the communication skills, presentation skills.”

Her sentiments were mirrored by a person recruiting for highly skilled computer scientists at a bank, who stressed non-technical skills. “We're looking for people we're expecting to be able to write quite well, and in particular, there's a certain ...style of writing that they're going to need to do, which is something that they can be trained in, especially as a younger person. If they have any of that in their background that would be very interesting.”

Another person reflected that, “Banking being a very, very procedural process kind of organization, a lot of those jobs that are very kind of manual and checkbox-like, are probably going to get eliminated. A lot of the lower-level jobs, of people who are just kind of a cog in the bureaucracy, I think those jobs could be in real trouble.” In response, he commented,

“I would say probably one of the most powerful combinations for new students getting out of school is going to be a combination of extremely strong and high end intellectual and technical skills. For example, being able to code. Even that may have a horizon on it, because soon enough, the code is going to write its own code. In the meantime, if you can do that kind of coding, very, very helpful. If you can do those kinds of mathematics, very, very helpful. Also if you have the ability to be thinking ... For the good jobs, right? If you can show ... I would be impressed by someone who knew how to code well and did really well in philosophy or Latin, because it would just show me their ability to think through these complex problems, but do it with the technical skills that we need to have.”

Even fairly low level jobs, like call center positions, stressed the importance of being able to combine knowledge and personal skills. “Specific to a call center position... it's not that important anymore that they know about product lines. That's something we can teach. What's

important now is how you treat the customer. That's something that's very hard to teach. This is something that's true for most customer facing roles... That's been a big shift."

At the same time, we were told by many respondents that, "we think about succession planning." Even lower level jobs were looking for people who could combine personal skills with the ability to understand performance data.

This combination of skills was quite rare, employers acknowledged. Often, applicants skilled in one dimension – like the technically proficient foreign born applicants – might be lacking in the other. "Language and culture can be a barrier," said one respondent. Ultimately, respondents felt like major changes would be needed to address this shortfall. "It's going to take an attitude shift... away from saying I'm not good at math and math is really hard."

Conclusion

The trends in the finance industry are quite different from those in manufacturing, particularly because so many jobs already required a Bachelor's degree even before the Great Recession. However, there was some evidence that employers were demanding greater skill in response to regulatory or technology changes and that they were more able to find workers with those qualifications (e.g. an advanced degree or five years' experience) during the recession. Unlike manufacturing, financial firms were willing to pursue a variety of strategies to fill vacant positions that included hiring foreign or part-time workers as well as offering training to less-qualified candidates. Since the end of the recession employers also feel like they are in a buyer's market and so are choosing to make the hiring process more applicant friendly, be more proactive in identifying candidates in advance, increase transparency to boost long-term retention, and automate pre-screening for low-skilled positions. Looking forward, finance hiring

managers are looking for workers that have not only robust quantitative skills but also well-developed soft skills to fill positions throughout the sector.

C. Healthcare

The healthcare sector is one of the fastest growing sources of employment in the United States and many of the jobs within healthcare are middle skill jobs. Between 2004 and 2015, employment in the healthcare and social assistance industry grew by an annual compound growth rate of 2.4 percent, the fourth fastest growing among the major industrial sectors, while the percent growth across all non-farm industries was 1.1 percent. Health and social assistance, however, had the largest change in employment between 2004 and 2015, and accounted for 23 percent of all the job growth between those two years. Employment in healthcare and social assistance was slightly under 10 percent of all non-farm employment in 2004, trailing retail trade, the largest sector with the 11.1 percent. By 2015, healthcare and social assistance was the largest major industry sector with 11.4 of all non-farm employment.

Jobs in healthcare

Within healthcare, healthcare support occupations, which contain most, although not all, of the middle and lower skill jobs in healthcare grew by 20.7 percent between 2004 and 2016. These jobs have been an important source of employment for immigrants and minorities. Within the Greater Boston Area, which was the location of the majority of our interviewed employers, immigrants account for 43 percent of healthcare support occupations. These occupations are predominately female. Females held 87.7 percent of healthcare support occupations in 2016. The healthcare sector is often one of the largest or the largest employer in many major urban centers. It is the largest in Greater Boston, employing 22 percent of employed workers in the Workforce Development Area of Greater Boston in 2016.

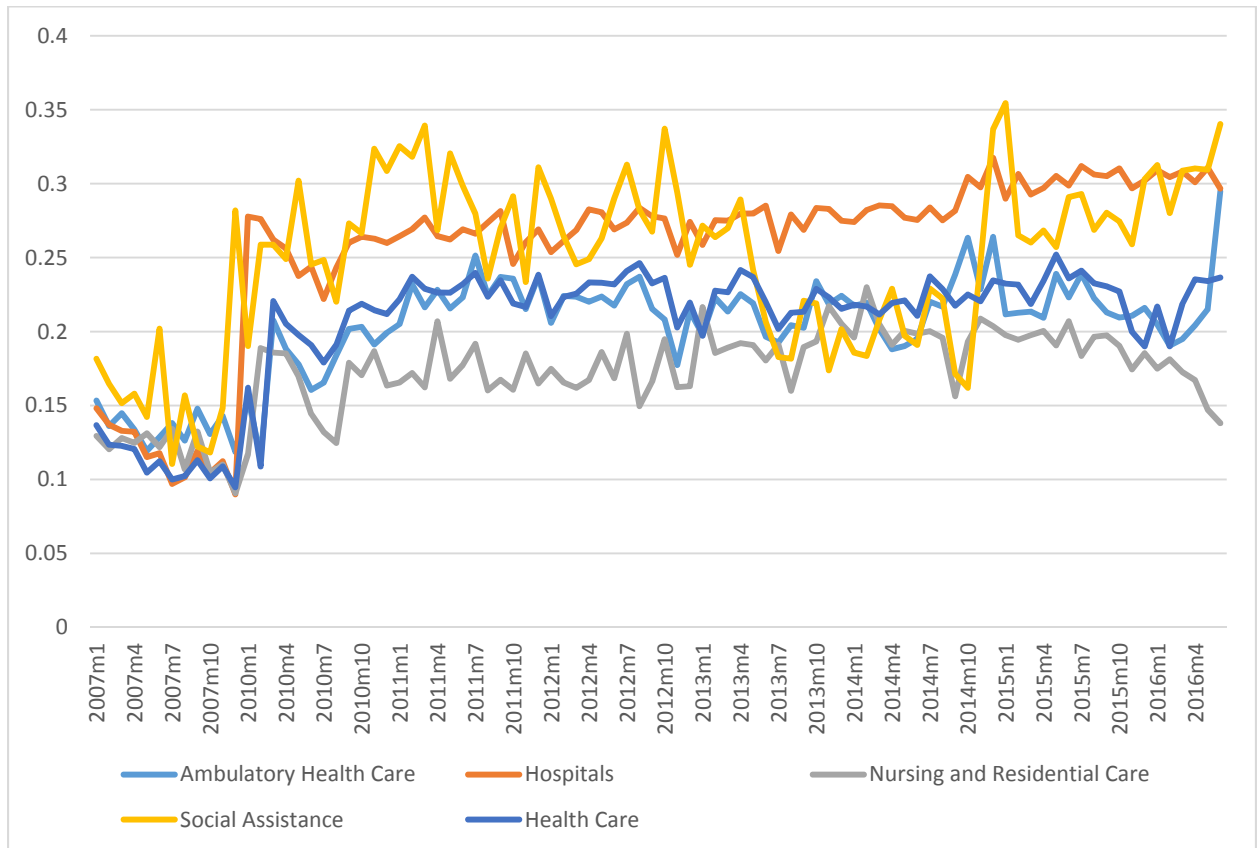
To learn about hiring practices in middle-skill healthcare jobs, we interviewed workforce directors and hiring specialists at six major hospital complexes that operate hospitals and specialty service centers, two community health centers; the head of Human Resources at an organization that provides home healthcare services; and hiring specialists at two healthcare insurers. In addition, we have gathered information over the last three years from conversations with, presentations by, and discussion among the participants at the bi-monthly meetings of the Boston Healthcare Careers Consortium. The members of the Consortium include workforce development officers from most of the healthcare providing organizations in greater Boston as well as officials from the area Community Colleges, private and for-profit colleges, universities, and training organizations. The jobs about which we spoke with the workforce development and hiring officials from the hospital complexes and home healthcare provider were middle skill healthcare provider jobs. With the hiring personnel from the health insurance firms, we spoke about administrative jobs, record keeping, and customer service jobs, primarily in call centers.

The Great Recession and its lengthy aftermath expanded the supply of candidates with more education and experience applying to the hospitals in Greater Boston. Our interviews and other sources that we tapped indicated that indeed there was a greater flow of better-educated candidates following the recession and many health care providers responded by hiring more of them. Changes in the types and scope of job responsibilities brought about by healthcare reform, containment pressure from the Affordable Care Act, Medicare, and Medicaid also appear to be influencing the skills and education levels employers are seeking.

The extent and nature of the changes in hiring requirements among healthcare employers appears to depend on what strata of the healthcare sector the employer occupies. This heterogeneity can be seen clearly in the job posting data where there is a long-term upward trend

in the share of employers requiring a Bachelor's degree among hospitals, but only a temporary increase in education requirements for nursing and residential care.

Figure 12. Share of Job Postings Requiring a Bachelor's degree or Higher in Healthcare



Our research suggests that there are in fact three different sectors. The top tier contains the research and teaching hospitals clustered in Boston. These hospitals are famous often throughout the world and attract patients from other parts of the U.S as well as from abroad. Such hospitals are in competition with each other and with hospitals from other U.S. cities. We found upskilling in these healthcare providers. Non-teaching and research hospitals further away from Boston in smaller cities form the second tier. As of now, we have not been able to interview hiring personnel at these hospitals and therefore cannot report on changes in hiring requirements and practices. We hope to do interviewing at several such hospitals in the fall.

The third tier in healthcare provision contains the community health centers, and the fourth tier has care facilities and home care. Community health centers, often referred to as Federally Qualified Health Centers (FQHC), have a mission to serve lower income and harder to serve populations and qualify for reimbursement under the Medicare and Medicaid programs. The Affordable Care Act (ACA) expanded the funding for FQHCs to accommodate the increase in lower income persons who would obtain health insurance under the ACA. The nature of the population served, the budgetary constraints FQHCs face and the job structure within the FQHCs all influence their hiring strategies and hiring realities. Nursing care facilities and home care provide care outside of a hospital, clinic, or health center setting. The jobs are physically demanding, the working conditions are difficult, and the occupational range is very flat. Nursing care facilities and organizations that supply home care typically hire Licensed Practical Nurses and Registered Nurses, which are the first two levels of the nursing occupational hierarchy.

In the interviews with hospital respondents, we typically focused on the largest middle skill health support occupations for which the hospitals are typically hiring. We spoke most often about the medical assistant job. All of our hospital and community health center respondents were currently recruiting for medical assistants. We also spoke to a lesser degree about other healthcare occupations, such as entry level nursing positions, typically registered nurse, which are higher in responsibility and skill requirements than medical assistants are, and certified nursing assistant and patient care technician, which are lower.

Medical assistants do varying combinations of both clinical and administrative tasks such as updating electronic medical records, taking vital signs, taking blood, giving (not prescribing) medications and immunizations, and assisting healthcare practitioners such as nurses, nurse practitioners, physician assistants, and physicians. The level and scope of responsibilities and

tasks for medical assistants varied somewhat among our respondents, and from discussions of the medical assistant job at the Boston Healthcare Career Consortium (BHCC), there is variation across healthcare employers generally. The responsibilities of medical assistants are evolving at all of the healthcare providers we interviewed. New emphases from the Affordable Care Act such as team based care, preventative care, and more extensive record keeping are influencing the tasks that the hospitals now include for medical assistants. Our respondents and a scan of job postings for medical assistants at the hospitals where our respondents were from showed an emphasis on very high customer service and communication skills, organizational skills, and computer skills for electronic record keeping. We discuss these skills further, and how the demand for them is changing, below.

Medical assistants receive training from public community colleges and private proprietary colleges. Both types of institutions provide certificate programs in the range of two semesters and associate degrees to prepare students to be medical assistants. All respondents said that applicants must have graduated from an accredited medical assistant program. They indicated that their applicant pool for medical assistants contains applicants with certificates and with associate degrees, students who are in a bachelor's degree program either nursing or another field such as biology who have obtained a medical assistant certificate or degree, and college graduates. College graduates must also have completed a medical assistant certificate. One respondent reported that about 25% of the applicants for the medical assistant job have a bachelor's degree. Respondents varied in the degree to which they hire applicants with each of these educational credentials. This depended on the role that medical assistants currently play within their organization, and the extent to which they see medical assistants as a source for jobs further up the job ladder in their organization. We will explain this variation further below. Two

respondents (and job postings at their organizations) said that they require experience in medical care. Three others indicated that experience is strongly preferred, and one did not require experience. One respondent said that he prefers to hire new graduates because they tend have better computer skills to deal with the new more extensive electronic reporting system, which in his case is EPIC, a system that several other respondents reported using. Those respondents indicated that they have increased screening for computer facility but they did not mention whether this affects the preferences between education and experience in hiring. More evidence on this will be extracted from the interview transcripts.

Changes since the Great Recession

All of the hospital respondents indicated that since roughly 2010 they had seen more college degree holders applying for entry-level healthcare support jobs such as medical assistant and certified nursing assistant. One respondent referred to this development as a “game changer” because of the increased caliber of the applicants. All the hospital respondents indicated that they have hired more candidates with bachelor’s degrees. One hospital respondent estimated that the increase has been in the range of about fifteen percent over the last five or six years.

Although we could not secure an interview with the relevant major area hospitals, a story appeared in the Boston Globe about a strategy they adopted two years ago to hire a greater number of bachelor’s degree holders, with degrees from a variety of fields including the liberal arts, for entry-level healthcare support jobs. The story discussed the job of clinical care technician, which is similar to a certified nursing assistant. College graduates are hired and given a six-week training program to learn the needed healthcare skills. Hires are typically aiming to go into the healthcare field, for example, nursing, physician assistant, or medical school. They indicate that turnover among the college graduates in this program is very low.

Bachelor degree hires in this program are asked for a commitment of eighteen months and 94 percent have so far have done so. The turnover rate among clinical care technicians was the 50 percent per year prior to this program. Because of when the Boston Globe article was published, we did not get the opportunity to ask our respondents to comment or whether they might consider such a program. One of our respondents reported that medical assistants [I have to check the recording to see if it is just medical assistants or other personnel as well] holding a bachelor's degree have lower turnover than the hires with associate's degrees.

At the same time as there has been an increase in more educated candidates, our respondents report an increase in the desired level of competencies to handle the increased responsibilities mandated by the Affordable Care Act as well as other reform models for primary care. We heard three types of increased responsibilities and tasks. The ACA is pushing for more team-based care, managed not necessarily by a physician or nurse, but by a person at the medical assistant level. Patient Centered Medical Home (PCMH) is a category in the ACA that captures this idea. The goal is to provide patients with more preventative health education and preventative screening for a variety of conditions that can lead serious conditions that are very costly to treat. Examples are obesity, diabetes, hypertension, asthma and others. Medical assistants would play the role of case manager and provide the preventative education and testing. All of these require more training and the capacity to do more complicated tasks than previously required. In addition, the ACA now pushes more extensive electronic record keeping using more complicated coding schemes. The reimbursement rates in the ACA provide inducement for adopting this approach.

One of the respondents described a grant she obtained to train incumbent medical assistants in the skills needed to play the more demanding role in the PCMH model. While she

said that they are not yet requiring that applicants for medical assistant jobs have all of these competencies, she expects that they will be screening more for the ability of entry hires to move up into the PCMH model of care. Other respondents mentioned the increased need for team and customer service skills, as well as the need for more computer facility to handle increased demand for electronic record keeping, and additional competencies to perform preventative education and screening tests. None of the respondents said they currently require all of these competencies but that they expect both to screen more for them and to develop ways to provide training for incumbents to acquire them. One respondent mentioned that they are hiring more medical assistants with associate's degrees who are enrolled in four year nursing degree programs as a way to get hires who will be able to move up to more demanding roles. They are hiring fewer candidates generally that they think cannot move beyond the job for which they are being considered. She also mentioned a concern in her hospital that incumbent medical assistants may not be able to master the skills needed to move to the higher roles and have established a committee that includes incumbent medical assistants to develop strategies to deal with this problem.

Our respondents indicated that they use behavioral tests to assess team and customer service skills. Again, the ACA has prompted much of the effort to screen for these skills. Hospitals are rated and their reimbursement is influenced by indicators of quality of care such as readmission rates and patient satisfaction among others. They did not yet know the effect this is having on the quality of their hires.

One area where the heightened emphasis on quality of care has affected hiring standards is nursing. Several respondents mentioned a very influential study done by the Institute of Medicine (IOM) in 2010 on the future roles nurses will play in the healthcare system. The

study reported research that indicated nurses with bachelor's degrees provided better care than nurses with associate's degrees provided. Two of our respondents said that their hospital no longer hires nurses with associate's degrees and have programs requiring the incumbent AA nurses to acquire a BSN with a certain specified time. [I can try to follow up with a phone call to a couple of other respondents to see if they have made a similar change]

Has hiring become more difficult?

One measure of the demands on hiring for a particular position is the turnover rate. In the Boston Globe article, we mentioned before the featured hospital reported a turnover rate of 50% for clinical care technicians before they began a program of hiring bachelor's degree holders for the job. This turnover rate clearly sparked a change in hiring strategy. Another respondent told us that the turnover rate among medical assistants was

In recent meetings of the Boston Healthcare Careers Consortium, there was a consensus that hiring medical assistants is difficult for a majority of the participants. The problem does not seem to be the quantity of applicants, but rather that finding candidates that can take on the increasingly demanding role is a challenge. One of our respondents indicated his hospital received many thousands of applications per year from which he hires 50 to 100 new medical assistants. In response to this concern, the Consortium has sent a survey to all area hospitals and clinics to gather data on the use of medical assistants across specialties. The survey asks for the expectations for education and experience among new medical assistant graduates, the number of applicants, the time from posting to hire, the number of vacancies, the turnover rate and the major sources of difficulty in hiring. The survey is underway and we hope to have access to the data when they are ready.

One development that may affect the skills that employers will be seeking as they hire medical assistants is a new regulation from the Affordable Care Act, requiring that all newly hired and incumbent medical assistants be certified. Certification can be granted from a number of accrediting organizations that can administer a certification exam and can offer or help an organization provide training in the competencies required for the certification exam. These competencies reflect the newer strategies for improved health developed under Affordable Care Act. These include more team based care and case management skills, preventative screening and preventative education for conditions that lead to serious diseases, and computer skills for more electronic record keeping. The certification requirement is quite recent, so implementation is evolving. Hence, we did not ask our respondents about how the certification requirement might affect the qualifications or experience they would be seeking. Our respondents did mention the increased need for some of these competencies as we discussed above. The survey mentioned above will collect information whether and how healthcare providers are responding to the certification requirement.

Community Health Centers

Several factors create a different situation for hiring medical assistants in the community health centers. Community health centers offer lower pay and lower promotion opportunities for medical assistants than do hospitals. In addition, respondents at both community health centers emphasized that their goal is to have medical assistants who reflect and therefore are able to communicate well with the populations the health centers serve. In the centers with which we spoke, the population served is low income and predominantly minority. One of the centers estimated that their population is about three-quarters Spanish speaking. The other center said a majority was Spanish speaking. Most of the medical assistants are from the communities the

center serves. One of the centers has a formal requirement of Spanish proficiency and lists this in their job postings. The other center indicates that being bi-lingual is not a strict requirement but is very strongly preferred.

The community health center respondents indicated that while they prefer to hire candidates with experience, they very frequently hire people for whom the medical assistant job is their first professional job. One of the centers has no medical assistants with an associate's degree let alone a bachelor's degree. All of them have certificates from a technical school with a medical assistant certificate program. The other center has some medical assistants with an associate's degree but the majority has a certificate from a technical school.

Community health centers also have fewer promotion opportunities for medical assistants than do hospitals. This combined with the relatively low pay afforded by the community health centers creates turnover levels that are of concern to the respondents with whom we spoke. One of the respondents estimated a turnover rate of twenty-five to thirty percent among medical assistants. Both centers are trying to create more growth possibilities within their centers for medical assistants in order to lower the turnover, but given the difficulty the centers face in offering higher pay, the options are limited. The budgets for the health centers are constrained by the reimbursement rates they receive from Medicare and Medicaid. Respondents from both centers indicated that they felt that they lose medical assistants to the area hospitals who can offer higher pay, but that this was not necessarily a bad thing, because they were creating the first step in a career for many of the medical assistants who leave them for better jobs in a hospital.

When we asked about whether the applicant pool had changed during the aftermath of the Great Recession the respondents told us that it had not. This reflects the fact that they recruit

primarily from technical schools and target candidates from the minority communities that they serve who have language proficiency in Spanish or another language from the populations served. When we asked whether the tightening labor market of the last few years has made recruiting more difficult, the respondents also indicated that the situation had not changed a great deal, although one respondent did say that vacancies are taking a bit longer to fill because people had more options outside of healthcare that had higher pay. In general, the problem for the community health centers is less with the flow of applicants than with retention because of the pay level they are able to offer.

Home care

One of our respondents was from an organization that provides home healthcare. The issues in hiring for home healthcare providers is somewhat different than for hospital, clinic, and outpatient care. There were some similarities in the hiring issues, however.

Primarily nurses, Licensed Practical Nurses (LPN), Registered Nurses (RN) or Nurse practitioners, provide home healthcare. Home healthcare organizations in general do not hire for a job like medical assistant. An LPN most work under the supervision of an RN. In addition to providing care, the home health nurse must do case management and electronic record keeping. There has been an increase in the demand for documentation and record keeping and our respondent indicated that he screens more for facility with computers among applicants. Another factor that is influencing the skill and experience demands for home healthcare providers is that the health situation of patients in the home has become more complicated. Patients spend less time in hospitals because of cost pressures resulting in patients requiring more types of care than if they stayed longer. In addition, in hospital and clinic settings more tasks are aided by

machines than before, and homecare providers must work without any but very portable equipment.

Our respondents said that in general, he does not hire directly from LPN and RN nursing programs. These programs do not teach homecare. He said homecare providers must have experience in homecare [I didn't see in my notes how they get the experience if they need it to be hired]. He indicated that experience always trumps education in his hiring decisions. Compared to several years earlier, he said he still looks for the same level of experience among applicants. Now, to screen for the higher demands put on homecare providers, however, he uses more behavioral assessment tools during interviews and does an observed visit.

Some nursing schools are developing residency programs for homecare and this will make hiring qualified providers easier. In general, homecare nurses make are paid less than nurses are in practice settings and this will continue to make hiring a challenge.

Healthcare insurers

We conducted interviews with hiring officials from two major healthcare insurers. These employers are insurance companies so the middle skill jobs in their organizations do not involve healthcare. The jobs on which we focused were call center jobs. People working in the call centers do primarily member service, including answering some questions about Medicare. Both respondents said that they hire some older worker without college degrees and returning mothers as well as college graduates. One of the respondents told us that about half of the call center hires have less than a college degree. Both said they are trying to increase the number of college graduates hired. They look for experience in customer service, often sales and sometimes from retail. One respondent said they provide six weeks of training while the other

said twelve weeks. They screen for high levels of communication and customer service skills. The jobs require very basic computer skills. ACA regulations have increased the level of data handling and use of information software. They screen for these skills but also incorporate them into their training. They expect the ACA and Medicare regulations to continue to put pressure for additional such competencies.

Both respondents indicated that hiring was easier a few years ago. They indicated that the slack labor market five or six years ago generated a large flow of well-qualified candidates. As the economy has improved, the applicant pool has decreased. People have more job options now. The pay is not terribly high. One respondent told us that the market rate was about \$38,000 per year to start. They have more trouble attracting good candidates at that rate of pay for call center jobs. One respondent summarized the situation by saying, “the talent market drives the job description.”

Turnover is a problem with call center jobs in general and our respondents indicated that it is for them as well. One responded mentioned that there is pressure for them to increase pay because other employers are poaching their employees. The respondents from this firm indicated that they are initiating retention planning and are considering more leadership development so that call center employees can move up within the organization. The other respondent mentioned that about 40 percent of call center workers move to other jobs within the organization such as sales, claims and enrollment.

D. Life Sciences

While not a large fraction of the total, employment in life sciences is growing and it is become a larger share of total employment within Massachusetts and within Greater Boston. From 2006 to 2016, employment in life science firms grew by 31 percent in Massachusetts and

by 15 percent in the Greater Boston area. Total private employment grew by 10 percent in Massachusetts and by 13 percent in Greater Boston during this period by comparison. Nonetheless, life sciences employment comprises only 0.34 percent of total employment in Massachusetts in 2016 (up from .28 percent in 2006). The corresponding figures for Greater Boston are 0.42 percent in 2016 and 0.41 percent in 2006. In the U.S., however, employment in the life sciences has been growing for the last four years, but has not yet regained the level it reached before the Great Recession hit in 2007.

To date, we have conducted interviews with three life sciences companies and one non-profit organization funded by industry, state, and federal monies whose mission is to enhance the development of the workforce for Massachusetts life science firms by connecting them with Massachusetts universities and community colleges to coordinate curriculum, developing internship programs, and generating information on employment and hiring trends within the industry. We are currently working to expand the number of interviews within this industry and are pursuing connections we have just recently been able to generate from the persons we were successful in interviewing. We have found gaining access within the life sciences industry to be more difficult than in the other three industries.

Middle Skill Jobs in the Life Sciences

Jobs within life sciences range from Ph.D. researchers to master's and bachelor's level research associates to lab technicians who may have either an associate's or bachelor's degree to production workers who more typically have a high school degree. The middle skill job on which we have tried to focus is the lab technician. It is the largest occupation for which there are job postings requiring only an associate's degree. In 2016, 41 percent of the posted job openings for lab technician listed associates degree as the minimum requirement. The remaining 59

percent listed a bachelor's degree as the minimum requirement. As a result, a number of Massachusetts community colleges have developed life sciences associate's degree programs, most often a lab technician program. The state has voiced a commitment to continuing to foster such programs, with backing from the current governor. Below we sketch our initial findings on the patterns of hiring of lab technicians as well as other occupations in life sciences and plan to expand on these findings as we generate additional interviews.

Skill requirements

We heard from two of our respondents that the skills required of people hired as lab technicians has not changed substantially over the past decade, although the products produced have. The respondent at the non-profit firm indicated that there has not been any substantial change in the skills that firms want graduates of community college and university programs graduates to have. A respondent at one of the life sciences companies corroborated this.

Hiring patterns

Two respondents noted, however, that while the minimum educational requirement is still an associate's degree, there has been a shift towards more hiring of candidates with a bachelor's degree. Both respondents noted two reasons. The first is that the Great Recession generated more bachelor's level candidates and the firms took advantage of the higher credentials. This has led to a preference for college-educated candidates that has persisted as the economy has improved and the competition for bachelor's candidates has heightened. Both respondents used the phrase "credential inflation" to describe the continued preference for bachelor's degree candidates.

The second reason is that a perception has developed that a person with an associate's degree, even though he or she may be fully equipped with the necessary technical skills, or even

better equipped than a college graduate, is more likely to be looking for a job rather than a career. A Bachelor's degree graduate is more likely to see the lab technician job as the first job in a career that will involve advancement to more demanding jobs over time. Both respondents noted that they are not sure there is evidence that this is necessarily true.

The respondent from the life sciences company noted that his company is committed to hiring a diverse workforce, and that working with community colleges to generate interns and hires is an important part of the strategy to advance the diversity count in their hires. The non-profit firm has is similarly working to help diverse populations in the community land jobs in the life sciences sector. They noted that there are particular firms that are working more closely with community colleges to take on more community college interns and hire a larger fraction of candidates with associate's degrees. The non-profit hopes to use the experience of these firms as a "success model" to encourage other life science firms to work more closely with community colleges. We plan to explore these themes with further interviewees to see whether this pattern of credential inflation is widespread throughout the industry.

IV. Observations across Industries

While it is important to be able to explore each industry's story individually, additional insights can be learned from comparing observations across industries to look for common trends or striking differences.

Skill requirements were changing in response to a variety of structural factors across most employers among the four industries that we studied. In manufacturing, global competition has shifted the industry from a high-volume mass production process to a smaller, more customized operation, resulting in a preference for factory floor workers with more years of experience. In finance, technology has expanded the capacity for using big data analytics and regulation has increased the need for more reporting, boosting demand for professionals with advanced degrees for high-skill positions. In healthcare, the Affordable Care Act has shifted reimbursement rates while increasing reporting and accountability for quality such that hospitals are looking to hire more educated nurses and medical assistants.

Most firms were able to find better qualified candidates when workers were more plentiful during the Great Recession. Manufacturers posted machinist jobs requiring five or more years of experience and filled them with workers that had been laid off by other firms. Banks listed requirements for data analysts that included advanced degrees and hired candidates coming out of graduate school during the recession with few options for employment. Hospitals restricted their search for qualified nurses and medical assistants to those with a Bachelor's degree and were able to fill vacancies without delay.

However, as the labor market recovered, employers across the four industries studies here noted that they have had difficulty filling positions with candidates that meet these higher skill

requirements. The time it takes to fill a vacancy has increased as the candidate pool has become less selective and/or plentiful.

Yet the strategies undertaken by firms to address the need for more skilled workers varied considerably across industries. In manufacturing, the primary response was to reduce the years of experience required (either formally or informally) and instead hire and train less qualified applicants for middle-skill machinist jobs. In finance, training was just one of many strategies that also included hiring foreign workers and part-timers to fill positions. In healthcare, there has been a movement towards building stronger relationships with community colleges and training programs to develop talent pipelines with specific schools while also improving retention of incumbent workers who often suffer from burn-out.

Looking to the future, most of the employers we talked to placed a high priority on the need for greater “soft-skills” across their organizations. In manufacturing this manifested in the need for workers to be more flexible and adaptable, willing to learn, and able to work in teams on multiple jobs simultaneously to keep the production process as lean as possible. In finance, there was a clear need for individuals with both solid quantitative skills as well as good customer service as jobs across the organization have become a hybrid of both data analytics and client interactions. In healthcare, hospitals are looking for staff that have a well-developed bedside manner to improve their quality of care ratings.

In response to these needs, the hiring process across industries has changed over time. In manufacturing, candidates are often required to work several hours on the factory floor as part of the interview process to see if they are a good fit with the team. In finance, employers have tried to make the hiring process more applicant friendly, to identify candidates in advance, to increase transparency, and to automate pre-screening. In healthcare, hospitals have formed a consortium

to bring employers and trainers together to strengthen relationships and have engaged in more behavioral screening for soft skills.

V. Conclusion and Next Steps

Across industries we found that skill requirements are indeed changing and that these positions have become more difficult to fill as the economy has recovered. However, there is a high degree of heterogeneity in the strategies that firms undertake to fill these positions when they have difficulty filling a vacancy. In some industries, such as manufacturing, employers are willing to lower skill requirements and train less-qualified workers while in others, such as healthcare, firms seek to develop relationships with community colleges and training programs to develop talent pipelines. Finally, all employers that we interviewed highlighted a need for greater soft skills across all levels of their organizations in response to higher demand for teamwork, customer service, and analytics.

Our next step will be to complete an additional 3-5 interviews in the life sciences industry to flesh out the story of changing skill requirements within the industry. Of the interviews that we have conducted there appears to be an interesting trend where rising skill requirements for lab technicians during the recession have become “sticky” as employers have expressed a preference for Bachelor degree holders without much evidence of their greater productivity over less educated workers.

Finally, we will draw on the evidence presented here to draft a working paper that will provide a suitable foundation for a variety of research products that are likely to have an interdisciplinary perspective. These include, but are not limited to, conference presentations, peer-reviewed journal articles, and policy briefs.

We've made great strides with our initial research in this area, and we are very grateful that we've had the resources from the Russell Sage Foundation to make that possible. Again, we hope that this new research will have a similarly large impact on policymakers and academics.

We would also be interested in proposing a journal issue devoted to qualitative or mixed-method research of employers as a possible topic for RSF: The Russell Sage Foundation Journal of the Social Sciences. Although qualitative and mixed-methods approaches are vital tools for policy research, they have not been well-represented in economics journals. Economics journal editors receive very few submissions using rigorous qualitative or mixed-methods and when received, referees have not reacted kindly. However, Russell Sage has a long tradition of supporting high quality research using qualitative and mixed-methods approaches. A journal issue devoted to rigorous use of these methods around a topic where traditional quantitative methods have fallen short could signal a willingness on the part of the RSF editors to publish such studies.

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