

Realism About Reskilling

Upgrading the career prospects
of America's low-wage workers

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Realism about Reskilling

AN OVERVIEW

Every person deserves the opportunity for dignified employment that provides living wages and potential for advancement. However, for many in America today, this is far from reality, as they are caught in a cycle of low-wage work, earning poverty wages, and unable to move up in the economy.

Local leaders, firms, and workers need to adapt quickly to keep pace with rapid technological innovation and its transformative impact on the U.S. economy. Using reskilling as a focal point, this report aims to provide policymakers with tools to do so by answering the following questions:

Who are the nation's low-wage workers, and what are their prospects?

We provide a detailed demographic analysis of America's low-wage workers and pair it with national labor market projections to understand their place in the changing world of work.

Where are the local opportunities for mobility, and how can policymakers expand them and help low-wage workers transition?

We develop a "near-term mobility index" and use it to identify the low-wage occupations offering opportunities for upward mobility.

How can the reskilling infrastructure adapt to the future, foster inclusion, and address the needs of any worker seeking upward mobility?

We pair a landscape analysis of the American reskilling system with a proposed "end-to-end reskilling journey"—a six-part framework that policymakers can use to build reskilling infrastructure that leaves no one behind.

Upgrading the career prospects of America's 53 million low-wage workers will not mean the end of low-wage work. The policy goal is for low-wage work to be a springboard, not a trap. We realize that this will be no small feat, but with tight labor markets, a steadily growing economy, and accelerating demand for new skills, the time for deep institutional change is now.

This research is directed toward several key players:

- Employers, who have as much to gain from skilled and motivated employees as they have to offer in specific knowledge.
- Leaders in skilling organizations (both public and private) and higher education, who know what works and can collaborate to deliver scale and market relevance.
- Policymakers, who must lead the effort to reduce the precarity of low-wage work and deliver opportunity to anyone who wants it.

To find answers, we start with the scale and pervasiveness of the problem—stagnant and unpromising low-wage work is prolific and deepening. Though it affects some more than others, the phenomenon of churning through low-wage, low-mobility jobs pervades all ages, demographics, and educational backgrounds. For many, the intersection of their identities and life experiences

makes the prospects for mobility especially dim. An inclusive lifelong learning infrastructure that meets workers where they are can help break the cycle.

Rapid technological innovation and big data, two drivers splitting our economy, can be leveraged as a solution, too. Analytical insights on companies' in-house talent pools have the potential to increase the amount and quality of training. Knowledge of in-demand jobs can help skilling organizations and universities see around the corner to deliver content that produces positive market outcomes. These insights have to be locally relevant, forward looking, and must avoid reproducing systemic biases.

Armed with such information, workforce development efforts can more efficiently and nimbly adapt to the needs of workers and firms. Properly aligned with economic development, such interventions can work in concert for amplified impact on workers' local opportunity. By engaging, coordinating, and nudging firms, policymakers can improve job quality while catalyzing wage growth. However, only by designing programs that alleviate the barriers and friction points people face in their reskilling journey can the reskilling infrastructure truly foster inclusion. With anything less, the accelerating demand for high-paying digital skills will lock in existing disadvantages and continue to widen socioeconomic divisions.

Chapter 1 summarizes the forces and policies that are reducing mobility and job quality in the United States while increasing economic insecurity through the proliferation of low-wage work.

Chapter 2 uses data from the American Community Survey to estimate the population of low-wage workers—a staggering 53 million people—to understand their demographic characteristics and geographical dispersion.

Chapter 3 uses the Current Population Survey and Bureau of Labor Statistics data to examine

how labor market dynamics shape the way low-wage workers move within and between occupations in a shifting job market. It develops a near-term mobility index that ranks occupations based on the economic prospects of workers transitioning out of them. It pairs the index with projections of local occupational growth to show how city planners can invest in key industries and design programs that provide workers with realistic opportunities for upward transitions.

Chapter 4 introduces the “End-to-end reskilling journey,” a framework to design and analyze programs from the perspective of the worker or learner.

Combined with our previous report, *Growing Cities that Work for All*, this report illustrates the trends affecting low-wage work and the implications for leaders aiming to improve worker mobility.

In the face of turbulent headwinds, reskilling alone is not enough

Low-wage workers are struggling—and not for a lack of new jobs.¹ The coming flood of innovation will create new tasks and occupations, and the labor market will demand new skills just as quickly as it will shirk others.² Robots may not be likely to wholly replace America's workers anytime soon, but the flood of new technologies will radically displace workers, eliminating jobs in some industries while expanding others.³

Policy and company responses have failed to keep pace with the skill-biased transformation of America's labor market. Economic growth has exacerbated inequalities, with the most vulnerable workers at risk of being left behind. As the labor market splits into low-wage and high-wage work, lower-tier jobs are precarious, marked by unpredictable schedules, reduced benefits, and stagnant wages. In the face of these trends, reskilling alone will not be enough to lessen inequality or provide equal opportunity.⁴ However, reskilling

will be integral to the social scaffolding that can support economically vulnerable workers.

Regional and city leaders aiming to foster a prosperous society confront dual challenges. They need to grow their economies, and they need to ensure that growth benefits all in society. Effective and inclusive reskilling requires:

- Locally relevant and forward-looking labor market information that suggests realistic opportunities for upward transitions into growing occupations.
- User-centric design with the flexibility to accommodate every individual's unique circumstances and to support them in their career goals.

Comprehensive solutions will improve both the quality and quantity of job opportunities. Through a combination of changes in company strategies,

strategic industrial development, and social scaffolding, stakeholders can prepare workers to adapt to a disruptive new economy, translating technological progress into shared prosperity.

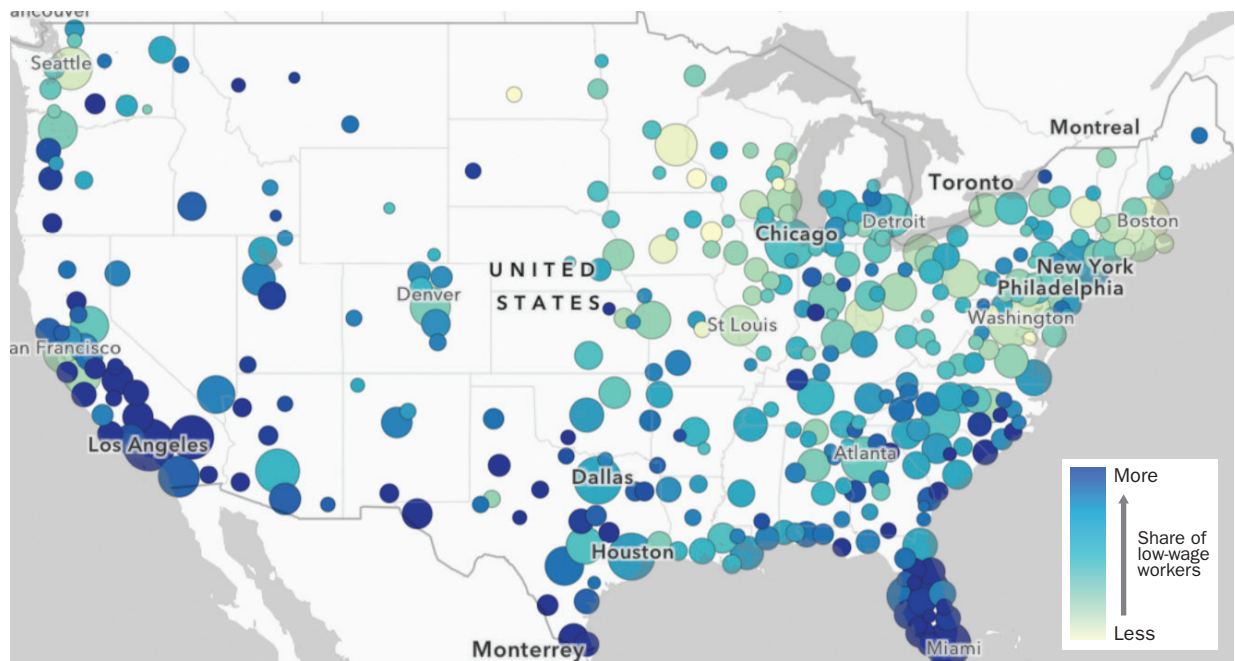
Who are America's low-wage workers, and what are their prospects?

To begin to answer these questions, this report estimates the population of low-wage workers. We find low-wage workers span race, education, age, and geography, with historically marginalized groups most at risk.

An estimated 53 million people—44 percent of all U.S. workers ages 18-64—are low-wage workers. That's more than twice the number of people in the 10 most populous U.S. cities combined.⁵ Their median hourly wage is \$10.22, and their median annual earnings are \$17,950. However, what counts as "low wage" varies by place. We define "low-wage workers" as those who earn

FIGURE 1

Concentrations of low-wage workers vary throughout the nation



Note: The size of each bubble represents the size of its respective metropolitan area.

Source: Brookings analysis of American Community Survey data (2012-2016).
Interactive map at <http://www.brookings.edu/research/realism-about-reskilling>.

less than two-thirds of the median hourly wage rate for full-time, full-year, male workers, adjusted for the regional cost of living. A worker in Beckley, West Virginia would be “low wage” if they earn \$12.54 per hour or less, but if they moved to San Jose, California, they would be considered “low wage” making anything under \$20.02.

Low-wage work spans gender, race, and geography, but not everyone is equally represented.

Reflecting structural inequalities, women and members of racial and ethnic minority groups are disproportionately likely to be low-wage workers. About half of low-wage workers are white, a quarter are Hispanic, 15 percent are Black, and 5 percent are Asian-American.

A Black worker is 32 percent more likely to earn low wages than their white counterparts—that number jumps to 41 percent for Hispanic workers. Altogether, women are 19 percent more likely

than men to be low-wage workers. Disaggregating by race and gender highlights the compounding sociological forces acting on low-wage workers.

Low-wage workers are geographically dispersed.

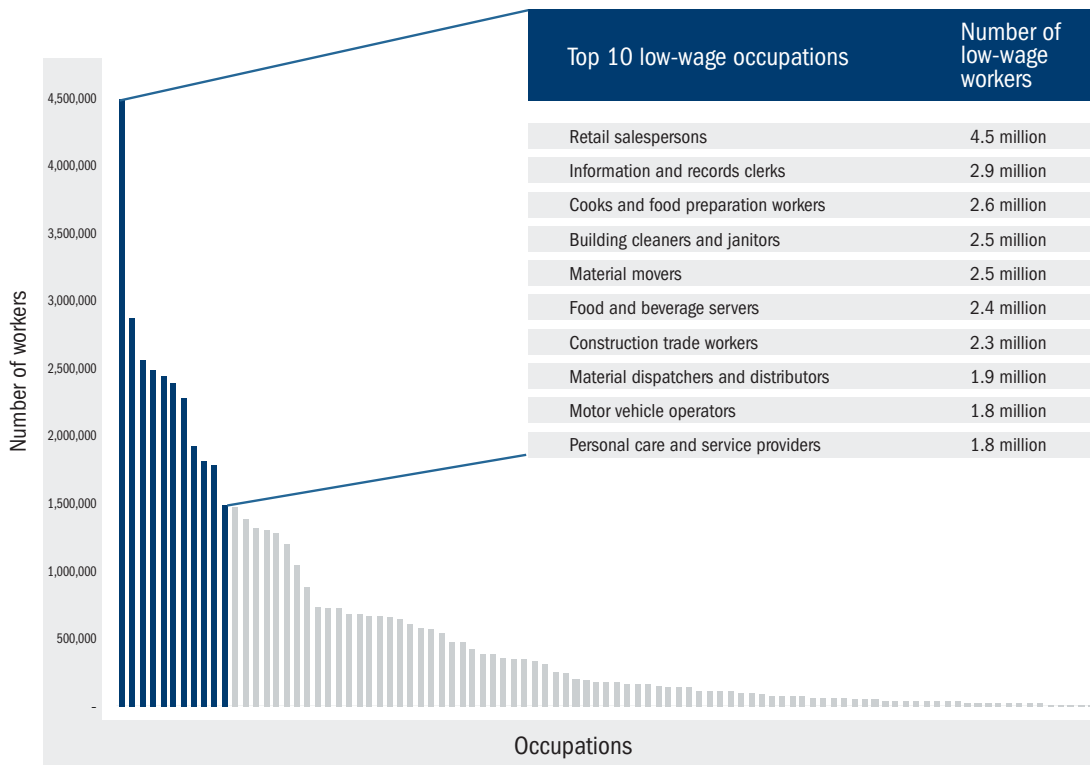
Across more than 300 metropolitan areas, the share of low-wage workers ranges from 30 percent of the total workforce to 62 percent. Small cities in the southern and western parts of the United States are home to some of the highest concentrations of low-wage workers, while many of the cities with the lowest shares are in the mid-Atlantic, Northeastern, and Midwest states. Despite varying concentrations, low-wage workers are distributed throughout the nation (figure 1).

Nearly half of low-wage workers are in just 10 occupations.

Forty-seven percent of low-wage workers, 25 million people, work in just 10 of 90 occupational groups. Most work in retail sales or

FIGURE 2

Almost half of all low-wage workers are in just 10 occupations



Source: Brookings analysis of American Community Survey data (2012-2016).

as information clerks, cooks, or cleaners (figure 2). Hosting high-wage industries does not guarantee a lower percentage of low-wage workers, and often the opposite is true. In many large cities, high proportions of low-wage workers correlate with more sophisticated industries. Hosting industries that attract high-wage jobs, like financial and information services, also generate demand for low-wage industries, like food service and retail, while driving up the cost of living. We also find that cities with higher proportions of low-wage workers tend to have a younger, less educated workforce.

Because complex industries can potentially drive growth and bring the unemployed and underemployed into the workforce, city leaders can

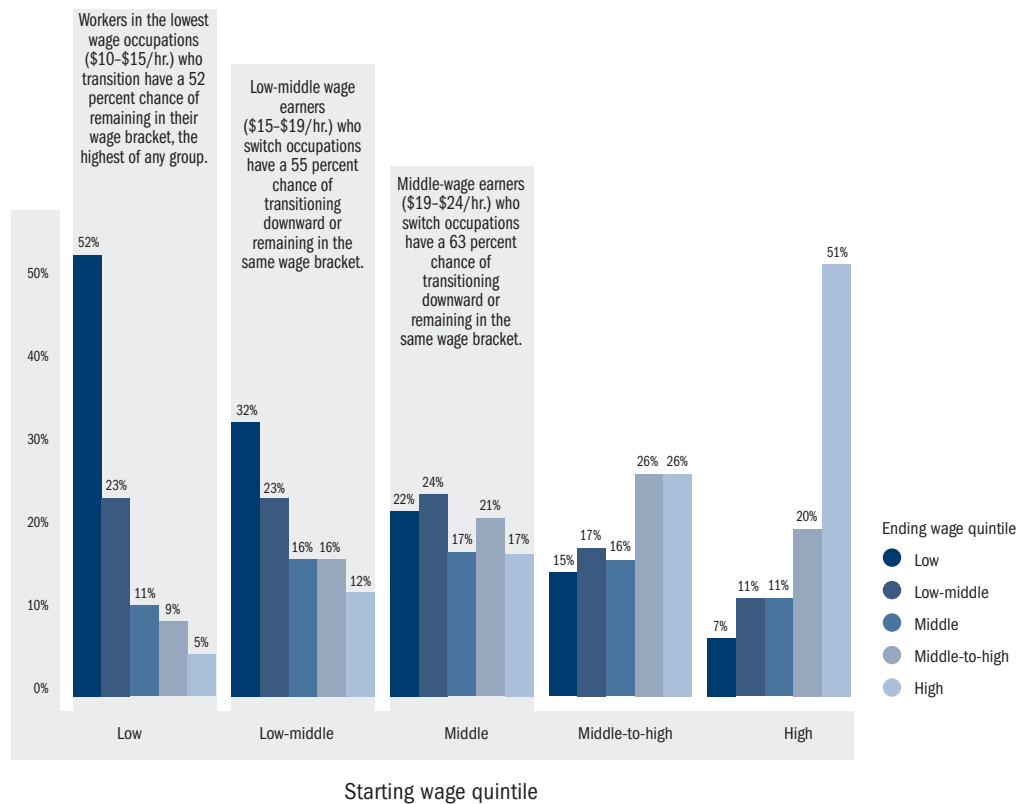
deliberately cultivate the capabilities needed to host (and attract) them. But urban policymakers must balance the need to host high-wage industries with efforts to support low-wage workers by increasing wages, improving job quality, and expanding access to housing, transport, and upskilling. The two sets of policies—to promote both growth and inclusion—are complementary, but they require distinct efforts.

A data-driven approach: Job transitions and opportunities for mobility

Workers who earn low wages switch occupations most frequently but tend to cycle between low-wage jobs. Workers in the lowest wage quintile (\$10-\$15 an hour) have the highest likelihood

FIGURE 3

Many low-wage workers transition from one low-wage job to the next

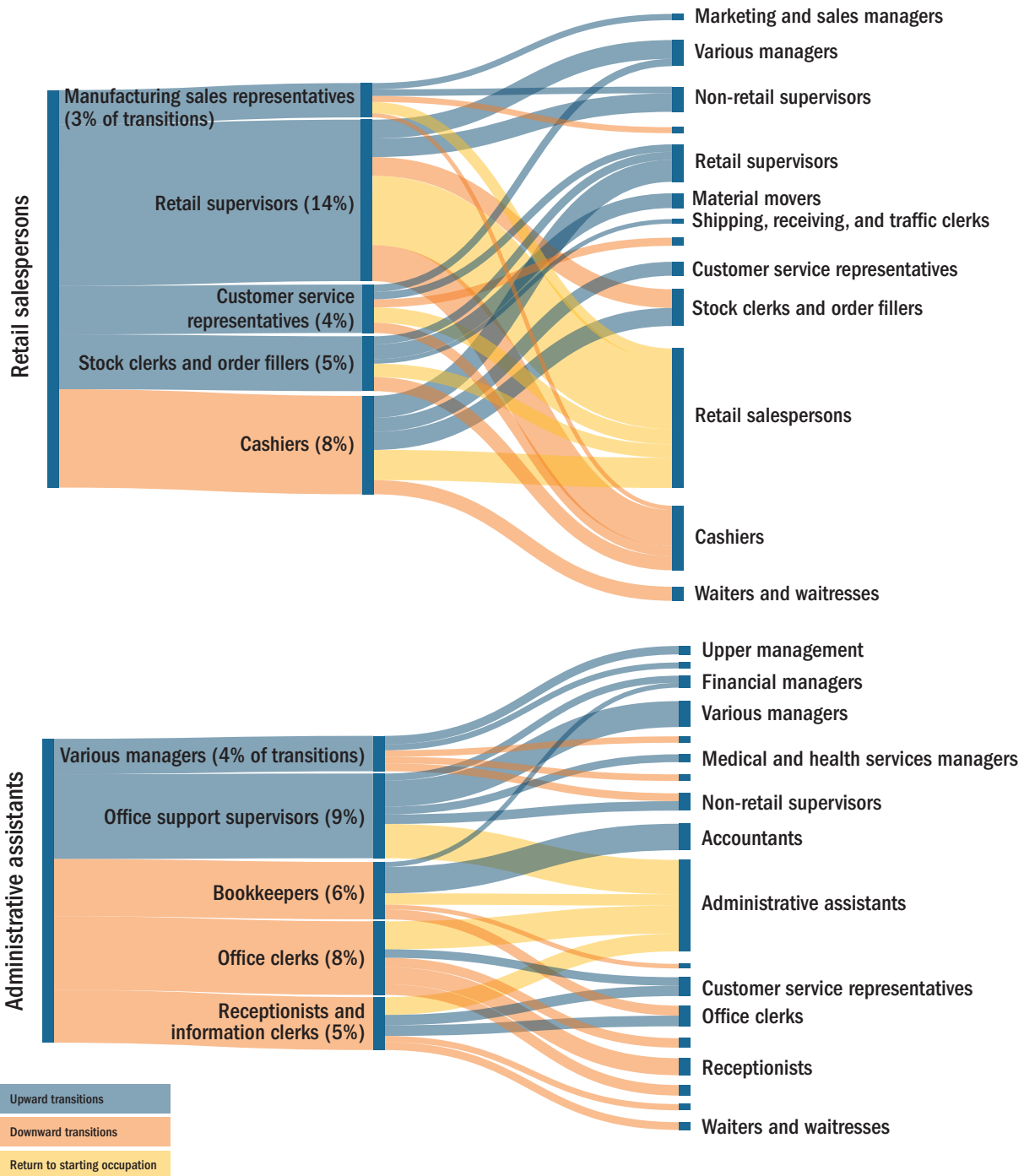


Note: The figure groups workers who switch occupations into five wage categories based on median earnings. For each group, it shows the likelihood of transitioning into each wage group in the next month, based on the starting position. It shows that low-wage workers are disproportionately likely to remain in their current position or transition downward.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

FIGURE 4

Workers departing certain occupations tend to have better prospects



Note: The two-step Sankey diagrams above show the relative likelihood (branch width) and trajectory (color) of the five most likely job-to-job transitions of retail salespersons and administrative assistants ordered by median wage. The second step gives a sense of possibility of dramatic wage increases while also showing how disproportionately likely it is that workers will return to their starting occupation or otherwise transition downward to another low-paying occupation. The probabilities in the second step are not conditioned on the first transition.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

of remaining in low-wage work when they make job transitions (figure 3). Those in low-to middle wage occupations (\$15-\$19 an hour) move either laterally or downward 55 percent of the time. Even those in the middle quintile are more likely to transition into an occupation that pays lower wages than higher wages. Rather than progressing in their careers, low-wage workers are more likely to churn within low-wage occupations.

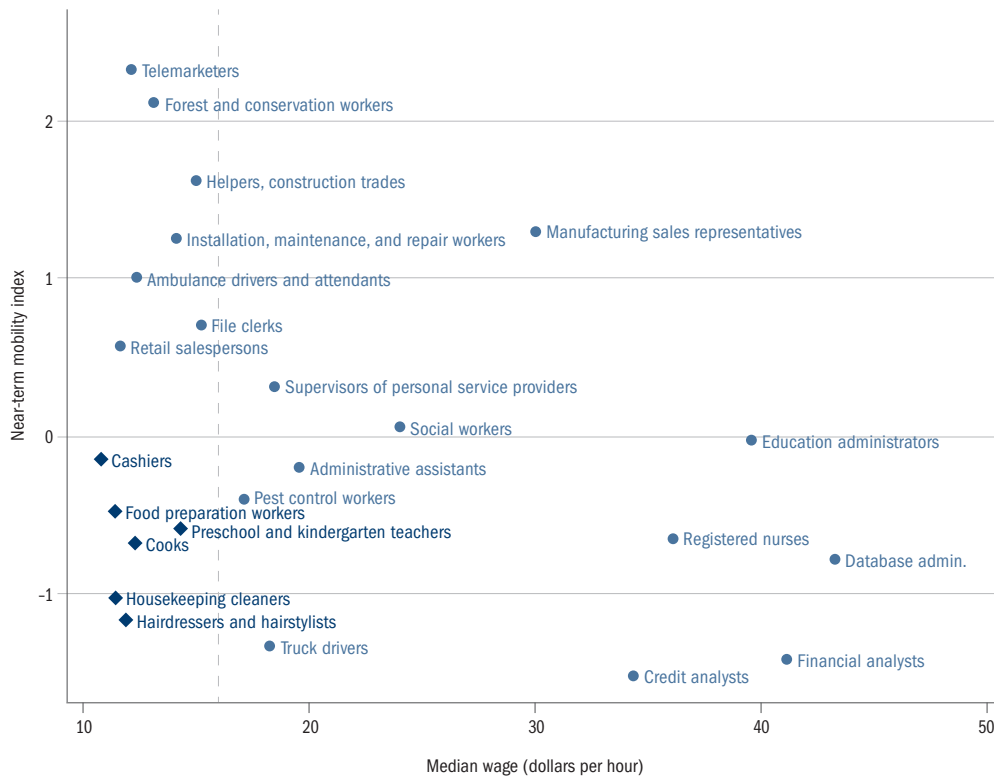
Some occupations are more likely to lead to higher-wage jobs. Workers in each occupation transition to a broad range of jobs, with occupational transitions reflecting a mix of promotions, lateral movements, and more significant career changes. The five most likely transitions for retail sales and administrative assistants are shown in

figure 4. “Upward transitions,” leading to above average wage growth, are in blue, while “downward transitions,” or those that lead to similar or lower wages, are in orange. The data suggest that prospects for workers leaving retail sales are higher than for those leaving administrative assistance; most of retail workers’ top transitions are up, while most for administrative assistants are down.

- **Strategic skilling, if connected to local opportunity, can be an engine for mobility.** To promote mobility, reskilling infrastructure can target destination occupations that are expected to grow, are likely to offer higher wages, and are realistic, given a worker’s starting occupation or employment history.

FIGURE 5

The most vulnerable workers are in low-wage, low-mobility occupations



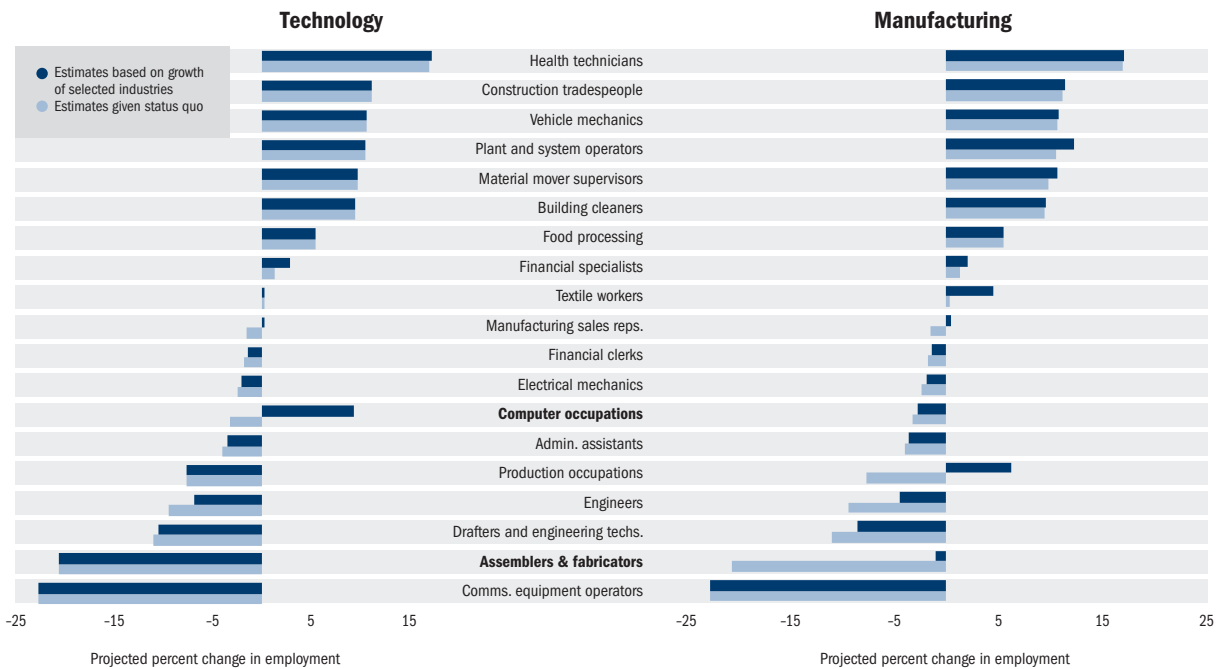
Note: To estimate the near-term mobility from a particular occupation, we measure the average transition from a starting wage, then estimate whether workers departing the occupation in question do better or worse. For instance, telemarketers tend to transition to a much higher destination than would be predicted based on their current wages. The plot shows only a selection of occupations. Workers in occupations toward the bottom-left of the plot are the most vulnerable; their occupations pay low wages and may offer little opportunity for advancement. The dashed line references the low-wage threshold at \$16.03 per hour.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

- Nationally, this could mean concentrating on skilling physician assistants to cater to an aging population as well as software engineers and business specialists—while deemphasizing training for occupations such as secretaries and office clerks, which automation is likely to make superfluous in the next decade.
- **When attempting to predict occupational growth and decline, regional variation is key, though national trends should still be considered.** Our findings show that local information can illuminate promising pathways for reskilling by aligning skilling efforts with place-based market demand. For example, while plant and system operator jobs are projected to decline nationally, they are likely to grow in, say, Boise, Idaho.
- **Comprehensive local strategies can link industrial and workforce development.** Workforce development is most promising when tied to specific economic development strategies.⁶ Our previous report, *Growing Cities that Work for All*, showed that cities facing job losses might combat the path-dependence of industrial trends by making strategic investments in industries that build on regional capabilities and also bring good jobs.⁷ Cities can focus on industries that absorb existing workers, while at the same time upgrading their talent as a strategy to attract and grow more complex industries. City leaders can pursue economic growth and support for low-wage workers in tandem. They can leverage place-based data to link industrial and skilling strategies and marshal resources to build on

FIGURE 6

Investments in strategic industries ripple through local job markets



Note: The figure shows how the robust presence of certain industries can affect projected occupational employment at the local level. On the left, we project the occupational needs of Boise, Idaho if it were to increase its competitiveness in technology industries: software publishing, data processing, and scientific research and development—and on the right in some manufacturing industries: beverage, chemical, plastic product, audio and video equipment, electrical equipment, motor vehicle, and medical equipment manufacturing. People are currently employed in these industries, but not at levels comparable to those in the rest of the country. We use a threshold of RCA (revealed comparative advantage) = 1 to model that the industry has a robust presence in a city.

Source: Brookings analysis of Bureau of Labor Statistics data (2018-2028) and Emsi data. Status quo projections are based on methodology in an earlier publication (*Growing Cities that Work for All*). See methods 2 in the appendix.

local talent, accelerate growth, and provide opportunities for their workforce.

Again consider Boise. To counter local displacement trends and catalyze growth, city leaders could foster tech industries and build the requisite human capital. They might expect employment in various occupations to change if the city were to see growth in software publishing, data processing, and scientific research and development. Note the expected percentage point change in growth in computer occupations (12%) –an occupation that is otherwise expected to shrink in Boise.

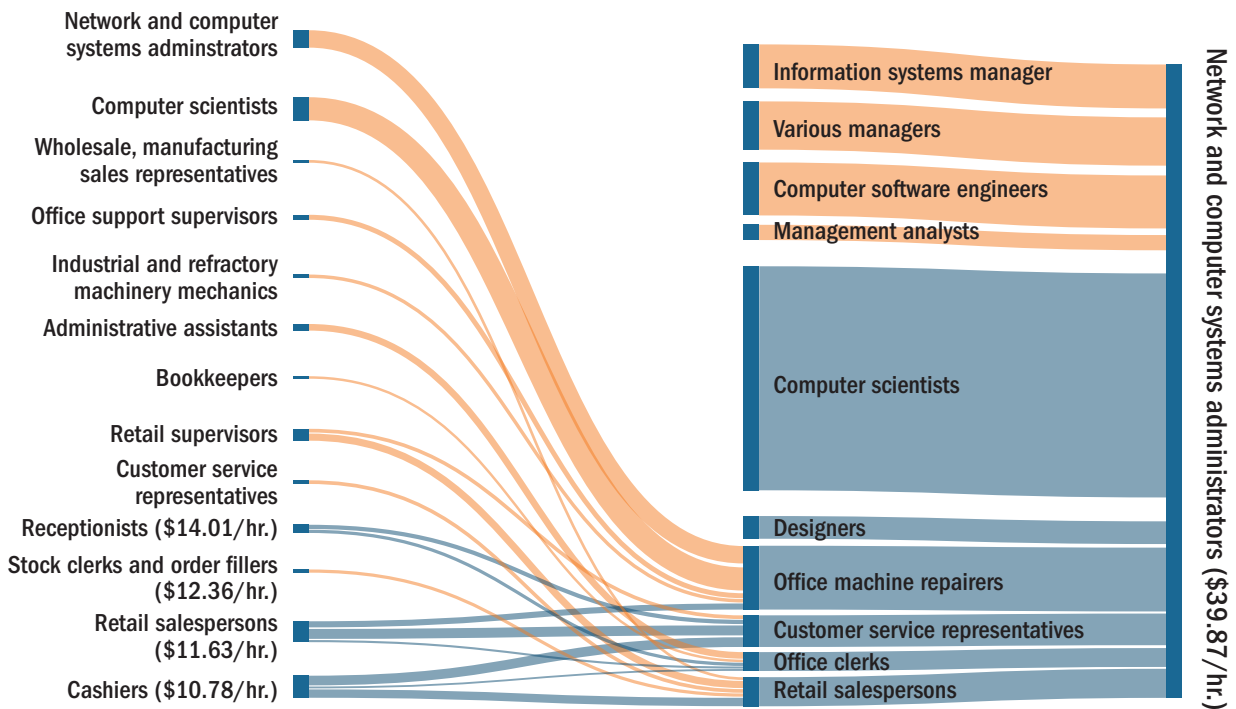
Depending on the priorities of local communities, a more utilitarian workforce and economic

development strategy might also focus on alleviating employment losses expected in middle-skill manufacturing occupations. Boise could expect shifts in employment if it were to host a set of industries in advanced manufacturing, based on their tendency to provide good jobs and employ people in occupations projected to shrink in the next decade (figure 6).

To fill some of the labor shortages in figure 6, workforce development in Boise could facilitate upward transitions for individuals employed in occupations expected to imminently recede. Transition data can equip them with the tools to identify these upward transitions. For example, office clerks and computer and office machine repairers are relatively likely to progress into computer

FIGURE 7

Actual transitions suggest where to target to lift low-wage workers



Note: The figure shows likely job-to-job transitions individuals make on their route to network and computer systems administration, an occupation demanded by firms nationally and in localities such as Boise, Idaho. The historical transitions of individuals between these occupations reveal an implicit skill overlap between the occupations and, most important, present and plausible transition based on historical precedent.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

occupations in just one job transition (figure 7). Both jobs are projected to decline both nationally and in Boise.

Realistic, upward, and efficient pathways to mobility might not always be intuitive. For example, as figure 7 shows, coveted computer system administrator roles may be just two transitions away from low-wage occupations such as retail salespersons or stock clerks. The implicit skill overlaps can be leveraged for mobility.

With such transition information, policymakers, firms, and educational institutions can pave efficient paths that reduce the economic precariousness of today’s low-wage workers. Upskilling payroll clerks and computer and office machine repairers for in-demand computer jobs might be a good place to start.

Synthesizing data on transitions, industrial forecasts, and local trends can thus give city planners a better understanding of the opportunities for the local workforce. But this will require a community-wide, systems-based approach involving skilling practitioners, economic developers, and firms.

Reskilling can act as a springboard in achieving upward transitions. But to be both effective and inclusive, program design must retain the perspective of the individual worker.

The user journey: Equal opportunity in lifelong learning

Historically marginalized groups are overrepresented in America’s low-wage workforce. So the reskilling infrastructure must foster inclusion and address the needs of any worker who seeks upward mobility. To this end, we develop the “End-to-end reskilling journey” (figure 8), a multi-dimensional framework to identify friction points the learners face and encourage holistic, intentional program design.

Stakeholders using this framework can design programs sensitive to the vulnerabilities and realities of America’s low-wage workers in each of six nonlinear dimensions of the end-to-end reskilling journey.

Encouraging user entry. Before workers can re-skill, they need to know where to begin. Low-wage workers are hard to reach—they face technological, financial, and even linguistic barriers that prevent them from pursuing reskilling opportunities. Many rely on their social networks for career advice, which can create a self-reinforcing cycle if no one in their circles has access to reskilling information. Up to 80 percent of adults have little or no knowledge of popular online learning resources such as Khan Academy and massive open online courses.⁸ Meanwhile, skilling providers devote too few resources to targeting low-wage

FIGURE 8

The end-to-end reskilling journey



workers, spending as little as a quarter of what consumer product companies spend on marketing.⁹ Providers must move beyond “if you build it, they will come” and be proactive and creative in reaching out to the low-wage worker.

Building self-efficacy. Once workers see the need to reskill, they must believe they can succeed.

Self-efficacy, and the persistence it breeds, are key to reskilling. But workers are frequently discouraged by systemic biases, financial precariousness, and negative interactions with educational institutions and other skilling providers. Self-efficacy can be taught, and learners need the opportunity to prove their competence to themselves. Indeed, learning interventions that promote task mastery have been shown to improve confidence in up to 97 percent of a firm’s workers.¹⁰ Self-efficacy is a powerful force that must be activated early and nurtured throughout a worker’s reskilling journey.

Navigating careers and systems. The job application, training, and transition process can overwhelm even the most seasoned professional. For low-wage workers, the stakes are high—one career misstep can be financially devastating. They need to know that a clear path to success exists, and how to leverage their existing skills to find and follow it. The current U.S. career navigation framework, which privileges formal credentials and relies on schools where the average student receives just 20 minutes of counseling a year, fails America’s workers.¹¹ Data can help align educational programming with local employer needs, setting workers on reskilling paths that strategically enhance their capabilities. Evidence suggests that workers who receive vocational support and follow technical, career-oriented pathways get better jobs and earn more. Governments and skilling providers must support them to do so.^{12,13}

Assisting with economic and social barriers.

The median annual income of a low-wage worker in America is just \$17,953—less than half the average cost of a degree from an in-state, public college.¹⁴ Consider that 29 percent of low-wage workers have children, 1 in 10 is a single parent, and 74 percent work 50-52 weeks a year, and the need for economic and social support becomes clear. Career services must do more than develop skills; they must provide wraparound support including childcare, tutoring, advice, and financial assistance. Low-wage workers will not progress professionally if they cannot first meet their basic needs.

Providing good content and good teaching.

Many workers who engage in reskilling need engaging and affirming content to turn information into usable knowledge. One in six U.S. adults has low literacy skills and one in three has low numeracy skills. When disaggregated along racial lines, 35 percent of Black and 43 percent of Hispanic adults have low literacy skills, compared with 10 percent of whites.¹⁵ Content and pedagogy must thus meet learners where they are, combining active learning strategies with flexible, psychologically-affirming education models that mitigate pernicious stereotypes.

Sustaining support.

A worker’s mobility journey does not end when they land their next job. To break cycles of poverty and economic stagnation, workers must continue to learn, grow, and achieve throughout their lives. Standard worker training often has temporary effects. In a recent study of federal jobs programs, 37 percent of workers were employed in the field they were trained in after four years.¹⁶ But long-term coaching and skills development support can have stunning results; in Cleveland, Toward Employment connected 560 residents to better jobs in 2018 through an individualized case management system—and provided follow-up services to every worker.¹⁷ Holistic partnership-driven approaches to worker development can direct them down a path of lifelong learning.

The path forward

Departing from a top-down or one-size-fits-all approach, this report merges information on national trends, local realities, and individual life experiences to inform policy options for building the workforce of the future. We hope its findings will help cities improve the mobility prospects of their low-wage populations by:

- Revealing the prevalence of low-wage work and characterizing the occupations of the low-wage workforce.
- Providing policymakers with a window into the forces driving the proliferation of low-wage work, both nationally and locally.
- Illuminating upward transitions available to workers and facilitating strategies that link industrial policy and reskilling efforts to drive inclusive growth.
- Assisting workforce development practitioners as they design programs to meet workers where they are.

A DATA-DRIVEN ROADMAP FOR CITY-LEVEL INDUSTRY AND WORKFORCE PLANNING

1 Do local industries have the potential to grow?

Regions can think strategically about the industries they foster to promote growth and inclusion. Cities can build capabilities to host industries that not only drive growth, but also offer good jobs for their workers.

Boise's strategic and feasible industries, 2017

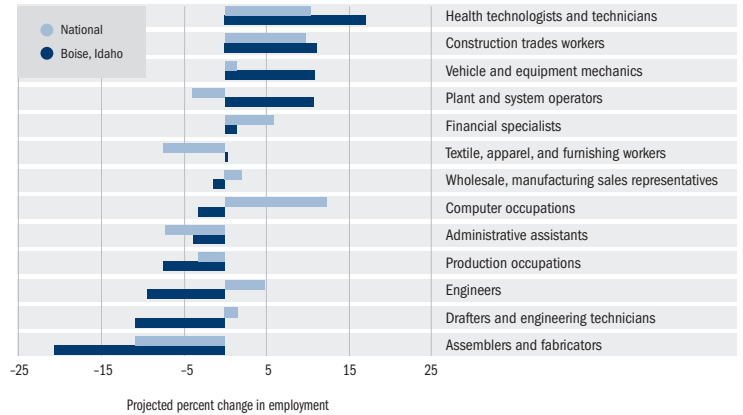


Note: Bubble size indicates industries' relative concentration of good jobs.

2 What are cities' workforce needs?

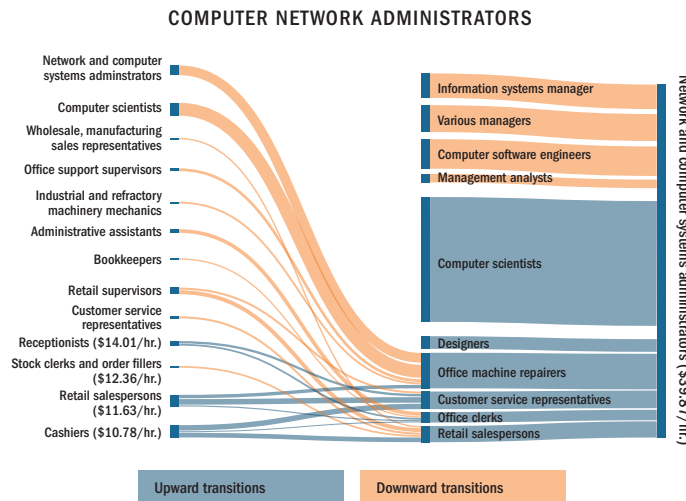
Global trends drive local workforce needs. But local industry structure also determines the regional demand for talent. Low- and high-wage jobs will be created and lost, and these will vary by city. Policymakers can use place specific occupational projections to help build the human capital that advanced industries seek.

Projected job growth by selected occupations, 2018-2028



3 Which workers are best able to transition and what avenues exist for low-wage workers?

Using data on actual job-to-job transitions, firms and reskilling organizations can help low-wage workers move into in-demand jobs such as network and computer systems administrators.

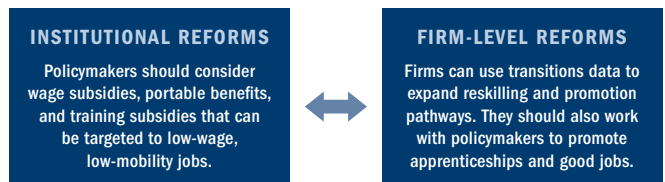


4 How can we help workers reskill?



Users need an entryway into the lifelong learning ecosystem, a belief they can succeed throughout the journey, a clear view of the pathways so skilling can translate to good jobs, help managing barriers like childcare and financial insecurity, scaffolded, engaging, and positively affirming content, and continued support for on-the-job success and lifelong learning.

5 How can public-private collaboration support workers?



Armed with this information, policymakers can design reskilling programs that tap into local talent pools and facilitate workers' realistic upward transitions into growing occupations.

CHAPTER 1

In the face of turbulent headwinds, reskilling is not enough

A college degree, for those who attained one in previous decades, guaranteed a secure lifestyle, a career, and a respectable income in the United States. Historic investments in education at the turn of the century spurred growth, reduced inequality, and offered mobility to millions. Today, however, graduates earn diminished returns on their investments as high tuition, stagnant wages, financial deregulation, and institutional barriers reduce educational attainment's boost to wealth.¹

For those without a college degree and with low incomes, conditions bode even less of a prospect. Less likely to participate in higher education, low-wage workers are also more likely to cycle through low-paying occupations and have little opportunity for economic mobility. They need a way out and require a robust and responsive education system just to stay afloat.

Rapid innovation, technological transformation, and the flood of digital tools into the workplace make learning and education indispensable to all workers around the country. In prior technological leaps, the United States responded to surplus market demand for talent through massive investments in public high schools and universities. Those investments narrowed the wage differential between skilled and unskilled workers, reduced inequality, and expanded opportunity by dramatically upgrading workers' ability to benefit from and contribute to productivity growth.²

Today, with economic change accelerating and the wage premium for skills increasing, the country's workers again require new institutional scaffolding to acquire the skills of tomorrow. But this time is different. The increasing pace of innovation means that workers require infrastructure

to support them as they skill, upskill, and reskill ever more frequently throughout their careers. Investing in compulsory secondary education or even universities will not be enough to meet the demand for these skills. And whereas prior decades offered decent wages and career pathways to those employed in middle- and low-skill work, somewhat softening the impact of exclusive education systems, current trends suggest that tomorrow's labor market will continue to squeeze the middle while expanding the divide between high- and low-skill work.³ Adapting nimbly to an increasingly skill-biased economy will require coordination among educators, legislators, firms, and workers.

Reskilling entices policymakers and philanthropists as a pathway to workers' opportunity regardless of individual circumstances. It is tempting to imagine social gains as low-wage workers shuffle into high-tech jobs. But this report is more reserved in its assessment of reskilling as a cure for diminished mobility and dead-end jobs. Improving the outlook for low-wage workers requires more than reforming the reskilling system. Cities need to look at the industries they foster. Firms and policymakers need to reexamine how to expand mobility and job quality within firms.

And low-wage workers need a new social scaffolding that better supports them and helps them climb higher in their careers. In short, the country requires a system-wide approach.

Reskilling will never be enough without broader structural changes, but it will be increasingly necessary. And the reskilling and adult education landscape as it stands today is ill-equipped to adapt most workers' skills to the jobs of tomorrow.

Disparate workforce development programs, in the absence of national cohesion or comprehensive federal policy, are trying to fill the void through adult education programs, boot camps, community colleges, online learning resources, massive open online courses, and partnerships between private firms and public higher education, among other interventions. For workers, the panoply of options is overwhelming and dotted with false starts and dead ends, with little return on investment for those most needing an employment boost through education.

The resulting system suits those already successful at navigating labor markets. Rolling out skilling infrastructure farsighted enough to train workers for tomorrow's technology, yet flexible enough to meet all of them where they are, requires more than funding and scaling—it requires curricular and technological design changes and reforms to the larger reskilling ecosystem. As workers adapt to the future, so must providers, funders, and firms.

Worryingly, the percolation of technology into the emergent reskilling system is poised to exacerbate polarization rather than foster inclusion.⁴ And providers and researchers will not foster inclusion if they measure success by counting the jobs filled or estimating the average treatment effect of a program. Evaluated based on these measures alone, even the most successful programs that target vulnerable groups may overlook the most marginalized.⁵ Scaling such programs will only scale their biases.

If the objective is inclusion, success is instead a workforce system's ability to alleviate the barriers facing individuals and to provide the desired mobility. Though we all navigate a process of lifelong learning, low-wage workers find the friction points more burdensome. They traverse the journey—deciding to reskill, acting on that decision, finding a program, finding resources to pay for training, and ultimately finding a better job—while facing adverse economic trends, and with higher stakes in systems and tools not designed for them.

Building inclusion means addressing those friction points. Lifelong learning infrastructure must be designed to support an array of learners from different backgrounds with varied needs, all the while delivering high-quality content relevant to the labor market.

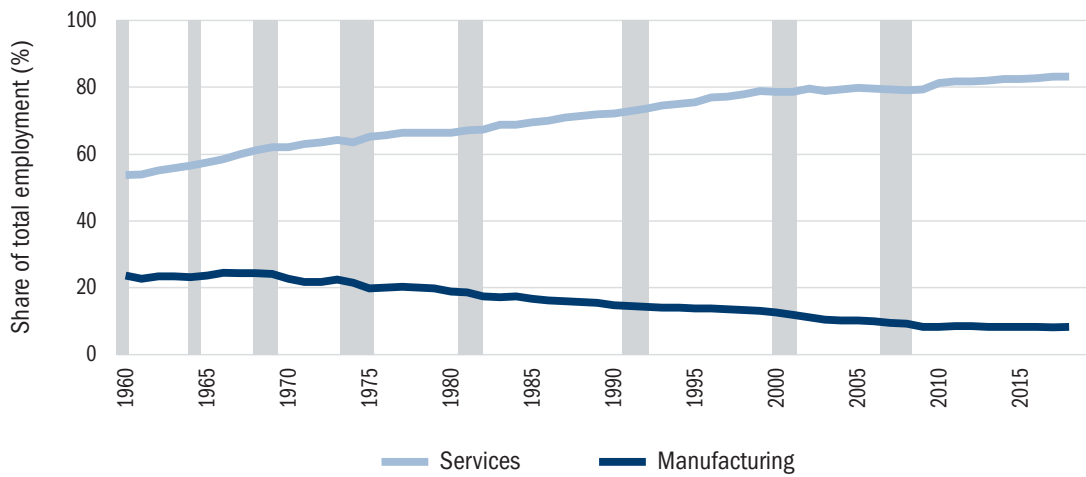
The marginal effect of trade on low-wage work

The longest economic expansion in U.S. history and a tight labor market are generating the first real wage gains many workers have seen in decades. At the same time, globalization and rapid technological change have contributed to shrinking the middle class and dividing the labor market into low- and high-wage earners. This section reviews the economic trends affecting workers, particularly those who earn low wages. It also reviews the domestic institutional factors affecting workers' livelihoods.

Low- and high-income countries alike have benefited by opening their economies to international trade and commerce, primarily through increased market opportunities, access to wider varieties of goods, and lower prices. Led primarily by the growth of China, more interconnected markets have given rise to a global middle class and lifted millions from absolute poverty.⁶ Despite aggregate economic gains, many low- and middle-skill jobs shifted away from the developed world and contributed to the decline of manufacturing employment in the United States.⁷

FIGURE 1.1

The dramatic shift of the U.S. labor force to services, 1960-2018



Note: The share of workers employed in manufacturing has decreased, while the share employed in the service sector has increased. This trend is largely due to changes in demand and productivity. The gray bars represent periods of national recession.

Source: Brookings analysis of Bureau of Labor Statistics data (1960-2018).

U.S. manufacturing employment (in terms of manufacturing's share of total employment) has been in decline since the 1960s, well before the rise of China (figure 1.1). This downward trend has been primarily driven by increasing productivity (U.S. manufacturers today produce more than they did 20 years ago with fewer workers)⁸ and a shift in demand from goods toward services.⁹ This trend of employment shifting toward service industries (which today constitute more than 80 percent of total employment), is typical in countries as their economies develop.¹⁰ And changes in trade policy are unlikely to meaningfully reverse the longstanding downward trend in manufacturing employment.¹¹

Even so, the negative impact of this shift in production employment has disproportionately affected the jobs and wages of low- and middle-skill workers, causing economic displacement in the industrial midlands of countries such as the United Kingdom and the United States over the past 40 years. As factories close, they leave cities and towns reeling from capital loss and talent flight. Many laid off workers are shunted into the pool

competing for low-wage jobs and consigned to collective wage stagnation.

Public policy can help manage these shifts with programs that help workers and cities absorb such shocks, diversify their economies, and grow more productively. As an example, the Trade Adjustment Assistance (TAA) program provides supplemental income and optional job placement and training services to workers displaced by the outsourcing of jobs. TAA, however, has conferred benefits to a fraction of those in need and has been largely ineffective at redeploying workers into the labor market.¹² In fact, for older workers, the program has had a negative impact on earnings and employment as compared with similar workers who did not participate in the program.¹³

But evidence suggests that the reskilling component of the program could be effective, especially for younger individuals and when the training provides high-demand skills.¹⁴ Taken as a whole, TAA's shortcomings underscore the importance of well-designed reskilling programs capable of meeting users' needs and connecting them with market opportunities. While reskilling and training

cannot solve all the problems of economic dislocation, they can be part of the answer if properly designed, targeted, and delivered just in time.

Technological progress: The long-run driver of change

In the digital age, skills and education are increasingly valuable. Computing is becoming faster and cheaper, fundamentally reconfiguring how humans contribute to economic output. For many occupations, better, more intelligent machines will complement human activity, and automation promises to relieve workers of mundane, repetitive, or dangerous tasks. These benefits in turn augur well for higher wages, better working conditions, and higher productivity. At the same time, technology will render other occupations throughout the skill spectrum redundant and, ultimately, obsolete. With some exceptions, such as home health aides, who are less at risk of automation, the occupations with the greatest exposure to automation-driven change in the coming years tend to be the lowest paid.¹⁵

This differential in occupations' susceptibility to automation, coupled with an increasing demand for highly complex, non-routine, and cognitive skills, means that technological change is driving a rapid skill-biased transformation of our economy and labor market.¹⁶ Continuous learning will thus be increasingly important for all adults to succeed in the labor market.¹⁷ This marks a change from the past, when many people were able to hold the same job or to stay with a company that promised both training and career progression.¹⁸

To adapt, workers will need to learn how to operate and coexist with new digital technologies. They will need not only new skills but also the ability to learn on the fly. The time over which a skill has value is shrinking. Over a five-year period, 35 percent of the skills demanded for jobs across industries changed, according to a report of the World Economic Forum.¹⁹ As accelerating technological change renders more and more tasks redundant, even workers in complex, non-routine

jobs will need to continually learn new skills to stay competitive.²⁰ Thus, reskilling will become ever more necessary for both low- and high-wage workers as technology, automation, digitalization, and increased global connectedness disrupt workplaces with growing frequency.

Technological change does not imply that all low-wage occupations will shrink or that tens of millions will soon be unemployed. But without labor reforms and a responsive skilling infrastructure, the labor market will continue to split. The earnings gap by education level is large and widening, with real wages stagnant for those without a postsecondary degree (figure 1.2). This split does not imply that universal college attainment will solve wage stagnation, but it does show the growing premium that firms are willing to pay to the right employee.

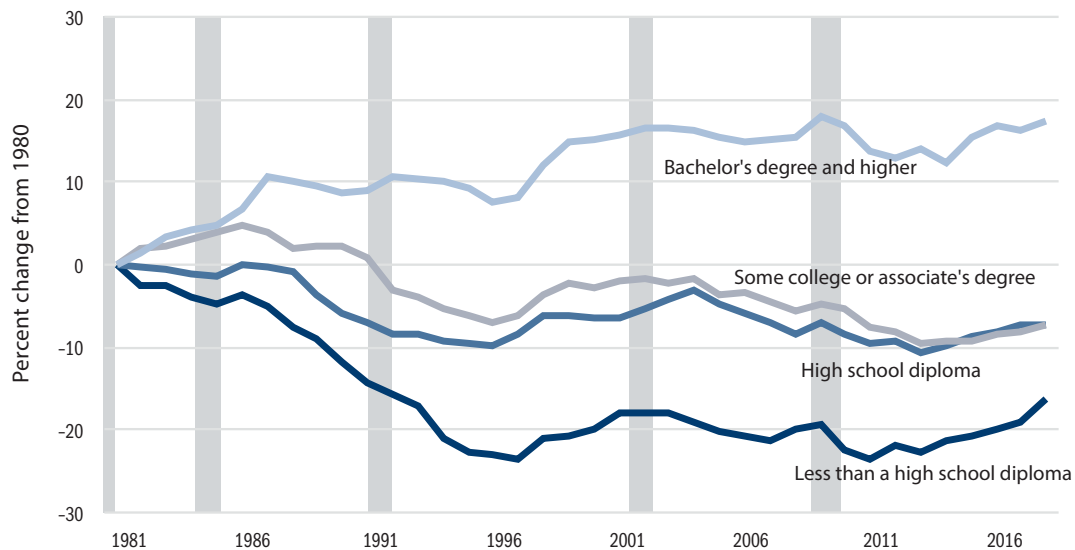
Many who work in low- and middle-wage occupations today will need to take on new, more complex tasks in their current workplaces or to transition to other occupations where employment opportunities are growing rather than shrinking.

The good news is that, since 1970, higher-skill jobs have grown faster than lower-skill jobs, increasing in share from 30 to 46 percent of the workforce.²¹ The bad news is that middle-skill jobs are shrinking, largely sending college-educated workers into higher-skill professions with higher wages, yet sending non-college educated workers into lower-skill professions,²² with many leaving the labor market altogether.²³ This gap is also a product of excessive screening out of workers without degrees and the lack of a skill-based marketplace where training and work can translate to opportunity.

Boosting upward transitions, especially for non-college educated workers employed in low- and middle-skill jobs, through a prescient, flexible workforce development system is vital to reducing inequality and providing firms the talent they require to remain competitive.

FIGURE 1.2

Over the past 40 years, the education wage gap has grown



Note: The gray bars represent periods of national recession.

Source: Brookings analysis of Bureau of Labor Statistics data (1980–2018).

Domestic institutions have compounded the effects of global forces

Rather than reduce this split, U.S. labor market institutions and policies have contributed to wage inequality, or at least failed to mitigate it. Given the economic forces just described, which depress wage and job quality, public policy has not kept up. Even the most basic protection—a minimum wage—has lagged behind the cost of living, contributing to the growing gap between low- and high-wage earners.²⁴

Recent executive action has also chipped away at worker protections. In 2019, the Department of Labor proposed a rule that would undo a 2016 proposal to tie the overtime eligibility threshold to the cost of living and thereby increase the number of overtime-eligible workers.²⁵ Recent administrative actions have undermined labor bargaining power, such as when the Department of Labor affirmed the status of workers of a cleaning company as independent contractors, who were thus ineligible for full-time benefits, even though they cleaned the department's offices.²⁶

The Department of Labor also proposed rules that would limit companies' liability for claims made by workers of a franchise.²⁷ Meanwhile, the National Labor Relations Board set a similar precedent undermining labor's power when it ruled that Uber drivers were not legal employees and thus were not afforded protections to unionize.²⁸

With the rise of gig work and independent freelancing, individual workers increasingly bear the responsibility to understand and retool for skills in demand. Contract work—which, by many accounts, employs a third of the American labor force and consistently neglects basic benefits for workers—has become a growing model within firms across the spectrum, not just in the “gig” or “sharing economy.”²⁹ The rise of contract work and the gig economy also lessens workers' redress in labor disputes. California's AB5 bill pushes for gig workers to be reclassified as employees, but since it contradicts federal directives, there is debate on whether it can secure gig workers the right to organize.³⁰ And although local pushback, from AB5 to New York's minimum wage for drivers, tries to upgrade worker

conditions, regulators must consider unintended consequences such as reducing workers' flexibility to set their own schedules, which serves as a de facto safety net in the absence of expanding opportunities.

Policy will struggle as it uses legacy tools to navigate new worker arrangements. New job categories that blend worker protections with contractor flexibility may improve some workers' job conditions but regulators need to make sure they do not risk moving full-time workers into a secondary tranche providing fewer benefits.

Growing monopsony further contributes to economic insecurity among low-wage workers.³¹ Worker mobility is constrained and pay is lower in labor markets where the number of firms is small. Declining competition among firms increases large firms' bargaining power and is associated with a decline in unionization, eroding workers' capacity to collectively bargain for wages and narrowing options for redressing labor disputes.³² Reduced bargaining power can also affect workers beyond wages and benefits, given that some unions offer apprenticeships and training programs.³³

Changed employer-employee relations also appear in the proliferation of noncompete clauses in employment contracts that prevent workers (including hourly workers) from competing with their previous employer and thus restrict job mobility and opportunity.³⁴ In response, almost a dozen states have passed or are considering bills to restrict noncompete clauses.³⁵ And a number of states have banned employers from asking job candidates for their salary history to reduce the information asymmetry between firms and workers and thus level the power imbalance in salary negotiations.

For the individual worker, it's not just powerful firms that dampen mobility and lower wages. Groups of workers can restrict the access of would-be competitors to work by lobbying for occupational licensing.³⁶ Licensing can also

restrict geographic mobility when requirements differ from state to state. And the burden of licensing tends to fall disproportionately on lower-income and less-educated workers.³⁷ Although licensing can certainly protect health and safety by assuring competency, such requirements are increasingly used as a form of rent-seeking in which groups of workers extract higher wages by entrenching their bargaining power. For example, there is evidence that some barriers to becoming a realtor exist only to limit the supply of realtors and have no impact on the quality of service.³⁸

Immigration, particularly of low-skill workers, is often perceived as a source of downward pressure on wages. Studies have suggested short-term pressure on local wages, but these effects are offset in the long run.³⁹ Overall, studies repeatedly show that immigration (high and low skill) tends to be positive for economic growth and job creation.⁴⁰ In the United States, for example, immigrants constitute 15 percent of the workforce, but 25 percent of the entrepreneur population and 28 percent of high-quality patent earners.⁴¹ The varying skills of immigrants tend to complement those of their native counterparts and contribute to job expansion.⁴² Policies fostering the productive integration and legalization of immigrants in labor markets can mitigate the potential short-term negative effects, offsetting costs, filling labor shortages, and creating new employment opportunities. If anything, the current curtailment of immigration through refugee quotas, increased denials of H1-B visa petitions—up from 6 percent in the 2015 federal fiscal year to 32 percent in the first quarter of the 2019 fiscal year—and lower numbers of student F-1 visas will all have negative effects on U.S. GDP and job creation.⁴³

Firm-level practices have pressured low-wage workers

Automation holds the promise of elevating unique human qualities, such as problem-solving, intuition, creativity, and persuasion, while increasingly

relegating routine tasks to machines. Helping workers transition to working alongside machines to improve productivity and job quality requires investing in training and in firm-wide operational changes. While many firms embrace the need for such reforms and implement them, data from the Census Bureau's Survey of Income and Program Participation show a downward trend. The share of employees who received training paid for by their employer in the past year fell from 19.4 percent in 1996 to 11.2 percent in 2008, while the share who received on-the-job training fell from 13.1 percent to 8.4 percent.⁴⁴ Although some reports indicate that employer investment in training may have rebounded somewhat as the U.S. labor market has tightened, little compelling evidence exists to suggest that the decline has reversed. This reinforces the need for firms to publicly disclose the amount they invest in training, as well as how training resources are distributed among employees in different wage groups and contract workers.

In some ways, productivity-improving technology, such as algorithmic management, has reduced job quality. Algorithmic management allows employers to closely track workers' activity to incentivize them to work faster and harder, but it often limits workers' autonomy and makes their shifts irregular. And it sometimes subjects workers to termination for arbitrary reasons. A National Public Radio episode featured UPS's hand scanner tracking system—it helped the company increase daily deliveries and shrink its workforce, but the speed-up also increased workforce injuries.⁴⁵

Compartmentalization of business activities has increased the outsourcing of such activities as back office, payroll, and janitorial service, including increasingly complex activities, leading to a more "fissured" workplace.⁴⁶ Classifying workers as contractors or using third-party agencies to subcontract work tilts power dynamics against workers by limiting their bargaining power and excluding them from the benefits or training that accompany a career trajectory within a firm.⁴⁷ Flatter management structures, and practices

of subcontracting low-skill jobs such as food and janitorial services, also reduce the mobility of low-wage workers.

Some management technologies proliferate as line managers look for cost-cutting opportunities without sufficiently considering worker conditions or the long-term benefits to the firm. Some firms have recognized the negative externalities of these practices, while others are under increased public pressure to improve worker conditions and include workers' voices in their governance structures.⁴⁸

The fear of employees being poached is often cited as the reason firms underinvest in training, despite often-cited skill gaps. Accounting rules have also contributed. Our current accounting system creates an incentive to invest in capital by allowing companies to depreciate capital assets, but not training or other investments in labor. Even when tax incentives for training or new jobs aim to encourage such investments, they are often not audited. Better measurement of investment in labor, as discussed in chapter 3 on the role of firms, would give policymakers better tools to incentivize training and allow firms to track investments that reduce turnover and increase productivity.⁴⁹

How reskilling fits

The collective effect of the economic trends, global forces, and institutional factors has been the increased precariousness of work and the further proliferation of low wages. Though median real wages finally rose from late 2014 to 2019,⁵⁰ and companies are searching for workers to fill job openings,⁵¹ 44 percent of American workers are employed in low-wage jobs. The costs of education and health care are rising,⁵² while the belief that leaders can meet these challenges is at a historic low.⁵³ Economic mobility has also declined. Americans born in the 1940s had a 92 percent chance of having better incomes than their parents. But for those born in the 1980s–today's

36-year-olds—the likelihood dropped to 50 percent, a coin flip.⁵⁴

The evidence is clear that workers with higher educational attainment are more resilient to economic change.⁵⁵ Yet education does not always translate to higher wages. For example, from 1979 to 2017, although low-wage male workers became more educated, their real wages fell.⁵⁶ The shift of employment from production toward service occupations weakened returns to their educational attainment.⁵⁷ This shift in the composition of the labor market is due in large part to increased trade and to technology.

Unless institutional barriers are addressed, and a proactive response is readied to counter economic headwinds, the next economic downturn is likely to affect workers on the lower rungs with increased severity.

The time is propitious to confront the array of forces acting on low-wage workers. The tightening of the American labor market and firms' urgent need for talent presents a unique opportunity to address the rising economic inequality tearing at America's social and political fabric.

In the face of such broad and complex trends, however, merely addressing the skills gap in order to increase wages, mobility, or inclusion ignores larger social and economic phenomena.⁵⁸ Meanwhile, technology is rapidly changing the kinds of skills needed for employment, creating a constant shortage of new science, technology, engineering, and mathematics (STEM) skills.⁵⁹ Appropriately-designed reskilling fits here, as a mechanism that can enable labor markets to meet rapidly shifting employer demand while providing workers a ladder for social mobility.⁶⁰

Today's reskilling landscape

The reskilling landscape today is made up of disconnected programs that, as a whole, struggle to serve low-wage workers and individuals already

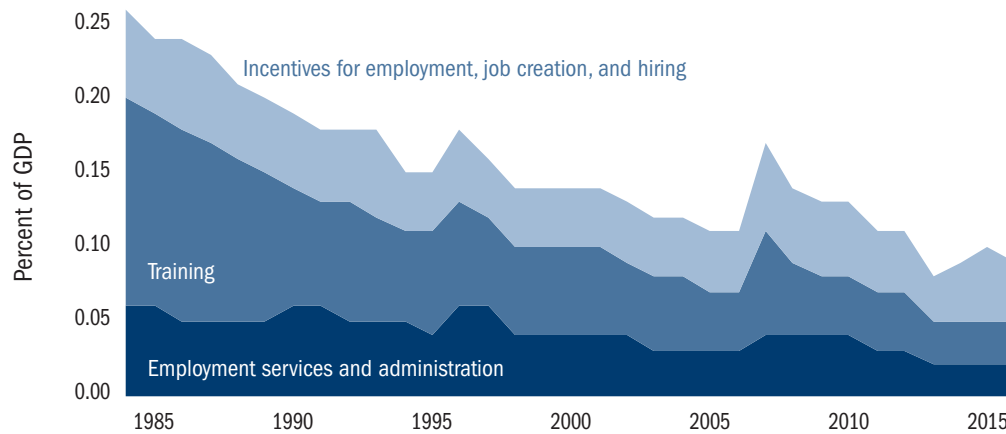
marginalized by other institutional structures.⁶¹ Together, the constellation of colleges, workforce programs, and other training providers form a Rube Goldberg contraption that often overwhelms individuals seeking to reskill or transition to a new job. Each program meets only some of the needs of some workers. People fall through the cracks and will continue to do so in the absence of system redesign and better coordination across players.⁶²

Over the past several decades, U.S. spending on reskilling has fallen dramatically. Federal funding for workforce development declined from a high of around \$24 billion (in 2017 dollars) in the late 1970s to \$5 billion by 2017.⁶³ In total, Organization for Economic Co-operation and Development (OECD) data indicate that U.S. spending on labor market programs (employment incentives, training, and employment services) has declined from almost 0.24 percent of GDP in the mid-1980s to just 0.08 percent of GDP in 2017 (figure 1.3).⁶⁴ Spending on training also declined, from 0.14 percent of GDP in 1985 to just 0.03 percent in 2017. Average spending on training across the OECD is more than four times higher—around 0.13 percent.⁶⁵ Additionally, the financial safety net for jobless Americans is about half the average size for OECD member states and has shrunk since the turn of the century. For a family with two children, for example, guaranteed safety-net benefits in 2018 would amount to only one-fifth of the typical U.S. household income.⁶⁶

A March 2019 Government Accountability Office (GAO) report on U.S. federal education and training programs found that the number of people served by the programs since 2011 declined by about 56 percent. Downward trends in financial investment and reach are compounded by noncooperation among workforce development agencies and their constituents. The GAO report identified 43 federal employment and training programs administered across nine agencies, with substantial overlap in services and fragmentation across departments.⁶⁷

FIGURE 1.3

The U.S. government has invested less and less in labor market programs, 1985-2017



Note: “Incentives for employment, job creation, and start-ups” includes subsidies for the productive employment and rehabilitation of persons with reduced capacity to work and general programs that promote hiring or self-employment of out-of-work populations.

Source: Organization for Economic Co-operation and Development data.

The bipartisan Workforce Innovation and Opportunity Act of 2014 (WIOA) aims to address this programming morass by, for example, mandating the Department of Labor and Department of Education to jointly map state strategies for workforce development and attempt to consolidate services through more than 2,500 one-stop American Job Centers throughout the country.⁶⁸ The effort to streamline appears to have fallen short, with Job Center customers still reporting a frustrating application process. Moreover, attempts to measure overall impact of coordination efforts are muddled by what the GAO called a “void of information on programs’ collective impact.”⁶⁹

Growing market demand for new skills, unmet by traditional education and training infrastructure, has generated an abundant, diverse, and innovative set of new skilling entrants. Some organizations teach skills specifically to meet firm demand and may offer only the necessary technical skills to land the next job. Others specifically target youth or marginalized communities and may teach soft skills such as time management, courtesy, and flexibility.

Some programs are described as *on-ramps*: short-term training that targets disadvantaged workers, providing a combination of soft skills required in the modern economy along with technical skills required for growing industries. Another growing class of organizations are last-mile training providers, commonly referred to as *boot camps*, which provide short-term, concentrated training in an in-demand industry. Boot camps are typically expensive and serve students with higher educational backgrounds (usually college graduates looking to augment their existing skills). Finally, online educational resources, in a variety of formats, have emerged to provide free or *freemium* models of education for career advancement. Freemium programs offer a baseline, free service while charging extra money for additional services. One example would be massive open online courses (MOOCs), which have been in the spotlight since the *New York Times* dubbed 2012 the “year of the MOOC.”⁷⁰ MOOCs are free, but to have the courses count toward a credential or diploma, providers increasingly charge a fee. Like boot camps, MOOCs primarily give already-educated learners the opportunity to augment their existing skills.⁷¹

Access to higher education and reskilling infrastructure is stratified along socioeconomic lines

The evidence suggests that higher education reaches too few people and reproduces socioeconomic inequality rather than reducing it.⁷²

Many gains of elite higher education are captured by the socioeconomically advantaged. A report by Raj Chetty and coauthors notes:

“...children from families in the top 1 percent are 77 times more likely to attend an [elite] college than children from the bottom quintile. This ratio is even larger in the very upper tail, where children born to families in the top 0.1 percent (income > \$2.2 million) are 117 times more likely to attend such colleges than those in the bottom quintile.”⁷³

Selective four-year universities increasingly cater to wealthier, whiter students, while resource-constrained two- and four-year schools are serving students from lower socioeconomic backgrounds who are disproportionately students of color.⁷⁴

The workforce development and reskilling infrastructure generally mirrors the socioeconomic biases of higher education. According to a recent Pew study, 63 percent of working Americans report engaging annually in learning or skill-building activities to advance professionally, including in the workplace. When disaggregated by educational background however, 72 percent of Americans with a college degree engage annually in professional skill-building or learning, compared with 49 percent of those without. For those earning \$75,000 or more, the share is 65 percent; for those earning less than \$30,000 a year, it is 40 percent.⁷⁵

The Pew study revealed that the use of digital resources for learning is also stratified. Of those with a college degree, 64 percent use the internet for at least some professional learning,

compared with 40 percent of those without a college degree. Despite the promise of technology for democratizing education access, 61 percent of adults had little or no awareness of distance learning, 79 percent had little or no awareness of Khan Academy, 80 percent had little or no awareness of MOOCs, and 83 percent had little or no awareness of digital badging, an emerging way to validate skills and competencies gained using digital resources.⁷⁶

Reskilling programs are often selective rather than inclusive

Programs are often constrained by budgets and by the need to quickly fill a company’s request. Many faster-growing new programs have achieved success by finding a niche of specific firm demand and a supply of workers qualified to meet that demand, except for some set of skills the program provides. A feature of this model is screening at the beginning to select for applicants who demonstrate persistence, academic readiness, and other factors that predict success.

According to a 2013 report that comprehensively studied more than 200 organizations operating 332 programs that served more than 120,000, fully 85 percent of programs indicated that they were partially or fully selective of candidates, enrolling far fewer people with a disability, a criminal record, a 10th-grade reading level, or only a high school diploma. The remaining 15 percent of programs, which were mandated to enroll everyone who came, demonstrated considerably lower outcomes.⁷⁷

The intensive screening indicates a system organized around output and employer needs, rather than one seeking to make lifelong learning a pathway to economic mobility.

Attempts to measure success and scale programs in reskilling can reinforce biases

In general, policy analysis of workforce development tries to identify successful programs and

methods to scale them. Analysts find success by establishing a program's impact on outcome variables such as wages or employment. Countless evaluations have established impact, almost always through randomized control trial (RCTs),⁷⁸ the "gold standard."⁷⁹ Indeed, this report cites many such evaluations as evidence of the effectiveness of certain programs.

But the specificity of RCTs is both a strength and weakness, because to rigorously answer whether a program helps its clients reach successful outcomes, researchers must define success precisely, and often narrowly. The possible narrowness can be particularly problematic in adult education. Researchers may estimate a program's average treatment effect but be unable to elucidate which component of the program contributed to the effect. In a 2014 report, the White House noted that workforce development studies often treat programs as untangled, black boxes of support structures, and so find it difficult to tease out which parts contribute to success.⁸⁰

Adherence to RCTs as arbiters of what works ignores the need to understand *why* some program or intervention works. Estimating an average treatment effect doesn't illuminate the learning process of a participant for whom the intervention was unsuccessful or perhaps even detrimental, nor does it offer insight into a remedy for that individual. RCTs do not generally account for the heterogeneity of program participants, program processes and implementation, or participant outcomes.⁸¹

Furthermore, RCTs regularly suffer from biases often overlooked by funders and analysts because of the lauded status of randomized design. For example, treatment and control groups are often assigned after participants have been screened, which biases program design toward individuals with more employable characteristics.⁸² Another source of bias is the impossibility of "blinding" participants about whether they are in the treatment or the control group, since subjects will clearly know whether or not they are enrolled

in a program. Participants' knowledge of whether they are in one group or the other could cause them to behave differently and so bias the results of the study⁸³—for example, nonparticipants may become less responsive to evaluators. Blinding is crucial to randomized design. A meta-analysis of RCTs where blinding is possible found that those that did not use a *double-blinded* design (where neither researchers nor participants know who was in which group) estimated treatment effects 17 percent larger than those that did.⁸⁴ In sum, RCTs alone cannot provide a complete sense of program quality, effect, mechanisms, or applicability to other populations and areas. They can be useful, but only given broader framing and understanding. Depending on them to scale programs will necessarily exaggerate biases associated with the intervention and evaluation.

Chapter 4 explains how a system-based approach for program design and evaluation can foster inclusion and better capture the complex and interconnected drivers of successful reskilling. Borrowing from design theory and user-centered design, we suggest an *end-to-end reskilling journey*, or user journey, taken by adult learners. This approach illustrates more clearly the cracks that participants in workforce development programs may fall through at any stage and provides a more holistic, long-term view of the factors that contribute to success or failure for participants as they reskill. Moreover, the approach through a user journey provides a framework within which RCTs or other quantitative methods can be deployed to investigate *how* and *for whom* reskilling works.

The user journey can provide a valuable, and too often absent, context within which users navigate these programs and a more complete view of who they are—not just as undifferentiated workers, but as people within communities and families, who have dreams and goals they strive toward and doubts about whether they will be able to achieve financial stability.

FIGURE 1.4

A low-wage worker's uphill journey



Note: Local policymakers, private sector leaders, and skilling providers must support low-wage workers throughout their uphill trajectory for economic mobility.

CHAPTER 2

Who are the low-wage workers?

Low-wage work spans geography, race, age, and educational attainment, with minority groups disproportionately locked out of labor market opportunity. The people and places most vulnerable to technological change and global trends require a robust social scaffolding and an intentionally designed lifelong learning infrastructure in order to stay afloat, let alone advance, in a rapidly changing economy.

To better understand low-wage workers, we employ data from the Census Bureau's American Community Survey, specifically using microdata from the 2012-2016 five-year sample to profile low-wage workers ages 18-64 nationally and in 373 metropolitan areas.

The analysis is a product of a collaboration with Brookings Fellow Martha Ross and Nicole Bateman at the Metropolitan Policy Program. An expanded analysis of the low-wage worker, and the dataset used, can be found in their report *Meet the low-wage workforce*, some excerpts of which are included in this chapter.

In some cases, holding a low-wage job is not particularly problematic. Think of a college student on her way to a degree, a 23-year-old with a bachelor's degree in an entry-level position opening a strong career path, or a teacher's assistant with a higher-earning spouse. In these cases, a low-wage job is a temporary way station or not the worker's primary financial support.

But for people supporting themselves and their families in low-wage jobs, the picture is grimmer. Think of a nursing assistant with two children, or someone laid off from a maintenance job who can only find lower-paying work, or a 50-year-old hospital housekeeper with no retirement savings.

To better inform strategies to help them improve their employment prospects, this section shows the diversity among low-wage workers at the national and regional levels. To provide a fuller picture of this large mosaic of workers and their extensive role in the labor market, we include almost everyone who earns a low hourly wage in our definition. We define the low-wage threshold as two-thirds of the median wage for male workers who work full-time, year-round, from a pool that excludes several special categories (box 2.1).

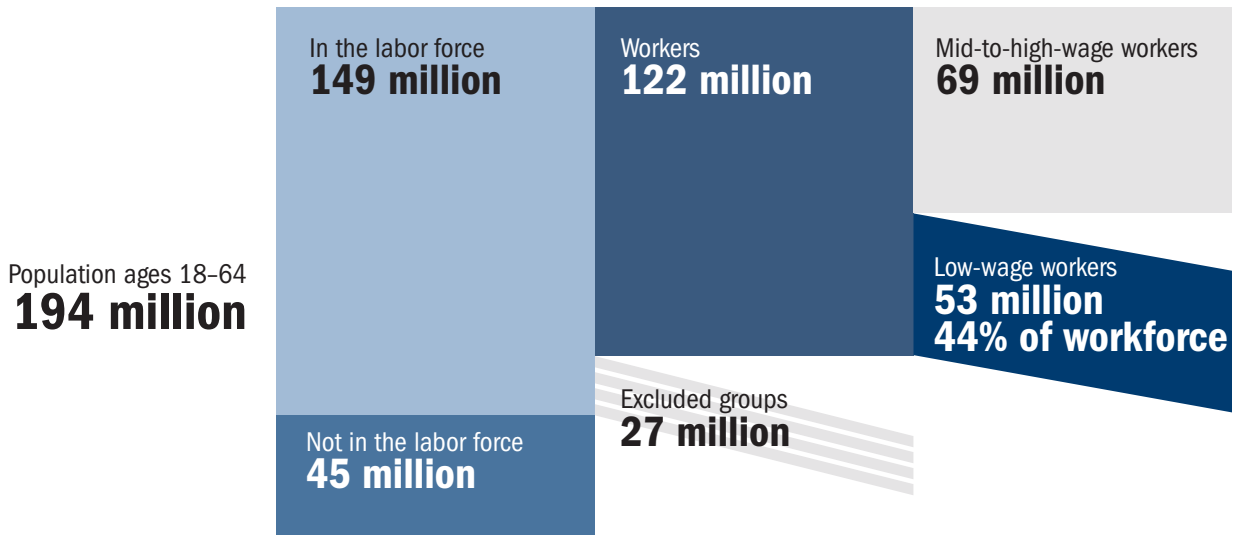
More than 53 million people —44 percent of all workers ages 18-64 in the United States—earn low hourly wages

After the specified populations are excluded, low-wage workers account for 44 percent of all workers and earn median wages of \$10.22 per hour and \$17,950 annually (figure 2.1). Low-wage workers are diverse. Some may temporarily make low wages, especially those who are younger and at the beginning of their working lives. Others may not be the primary earners in their families. But almost half of low-wage workers live in low-income families, showing that for tens of millions of people, low-wage work translates into financial vulnerability.¹

Most low-wage workers are in their prime working years or nearing retirement. Two-thirds of

FIGURE 2.1

Exempting some students and the self-employed, 44 percent of the American workforce—53 million individuals—earn low wages



Source: Brookings analysis of American Community Survey data (2012-2016).

BOX 2.1

How do we define low-wage workers?

Defining low-wage workers

Include:

- All civilian, non-institutionalized 18- to 64-year-olds who worked at some point during the last year and who are currently in the labor force (either employed or unemployed).

Exclude:

- All graduate/professional students.
- Traditional high school and college students (those working less than 14 weeks over the previous year, those living in dormitories, and high school students living at home).
- The self-employed/those with self-employment income.
- Observations with data quality concerns.

Defining a low-wage threshold

Median wages: From our pool of workers, we compare hourly wages to a low-wage threshold. We use the often-employed threshold of two-thirds median wages for full-time/full-year workers, but we only consider the wages for males. This limits gender inequality’s effect on our definition and yields a national threshold of \$16.03.

Geographic consideration: We account for variation in the cost of living across the country by adjusting the wage threshold using the Bureau of Economic Analysis’s Regional Price Parities (RPPs), which provide unique adjustments for the buying power of a dollar in individual metropolitan areas and states.¹ If the hourly wages of an observation were below the low-wage threshold we determined for their location, that observation is included in our sample of low-wage workers.

low-wage workers, about 34 million people, are ages 25-54, and almost half of this group (40 percent) are raising children. Another 6.5 million are ages 55-64. This population skews younger:

Almost one-fourth of low-wage workers are 18-24, although only 10 percent of all workers fall into that age group. Many of the young people earning low wages—particularly those with a college

degree or other post-secondary credential—will likely see their earnings rise with increased experience. However, about half of the young low-wage workers lack a college degree and are not enrolled in school, suggesting shakier prospects.

Low-wage workers are majority female and racially and ethnically diverse. Women are 19 percent more likely than men to be low-wage workers. Black workers are 32 percent more likely to earn low wages than white workers, and Hispanic workers are 41 percent more likely. Black women are 45 percent more likely than white men to be low-wage workers, and Hispanic women 54 percent more likely.*

Women account for 54 percent of low-wage workers, although they make up a smaller share (48 percent) of all workers. Slightly more than half of low-wage workers are white (52 percent), 25 percent are Hispanic, 15 percent are Black, and 5 percent are Asian. Whites are underrepresented among low-wage workers, since whites account for about two-thirds of all workers. Asians are only slightly underrepresented, since Asians account for 6 percent of all workers. Hispanic and Black individuals are overrepresented, making up 17 and 12 percent of the workforce, respectively.

Low-wage workers span the educational continuum but generally have lower levels of education. About 50 percent of low-wage workers have a high school diploma or less, considerably higher than the rate among all workers (35 percent). Smaller shares of low-wage workers have bachelor's degrees (14 percent) than the general workforce (31 percent). About 30 percent of low-wage workers have some college or training experience but no degree, a bit more than the general workforce (24 percent).

Many low-wage workers live in poverty

An estimated 30 percent of low-wage workers are secondary earners, meaning they live in a family

in which at least one other member works in a mid- to high-paying job. Twenty percent of low-wage workers are in non-family households. The remaining 50 percent of low-wage workers are primary earners or contribute substantially to family living expenses.

The federal poverty threshold is another useful tool to understand a family's economic conditions, as it takes family size and other earnings and income sources into account. Some 30 percent of low-wage workers live in families with incomes below 150 percent of the federal poverty line, or about \$36,000 for a family of four, compared with only three percent of mid- to high-wage workers.² Just over a quarter of low-wage workers receive some sort of public assistance in the form of Social Security Income, public assistance income, SNAP (food stamps), or Medicaid, compared with eight percent of mid- to high-wage workers.

Hosting complex industries does not guarantee having fewer low-wage workers, and sometimes the opposite is true

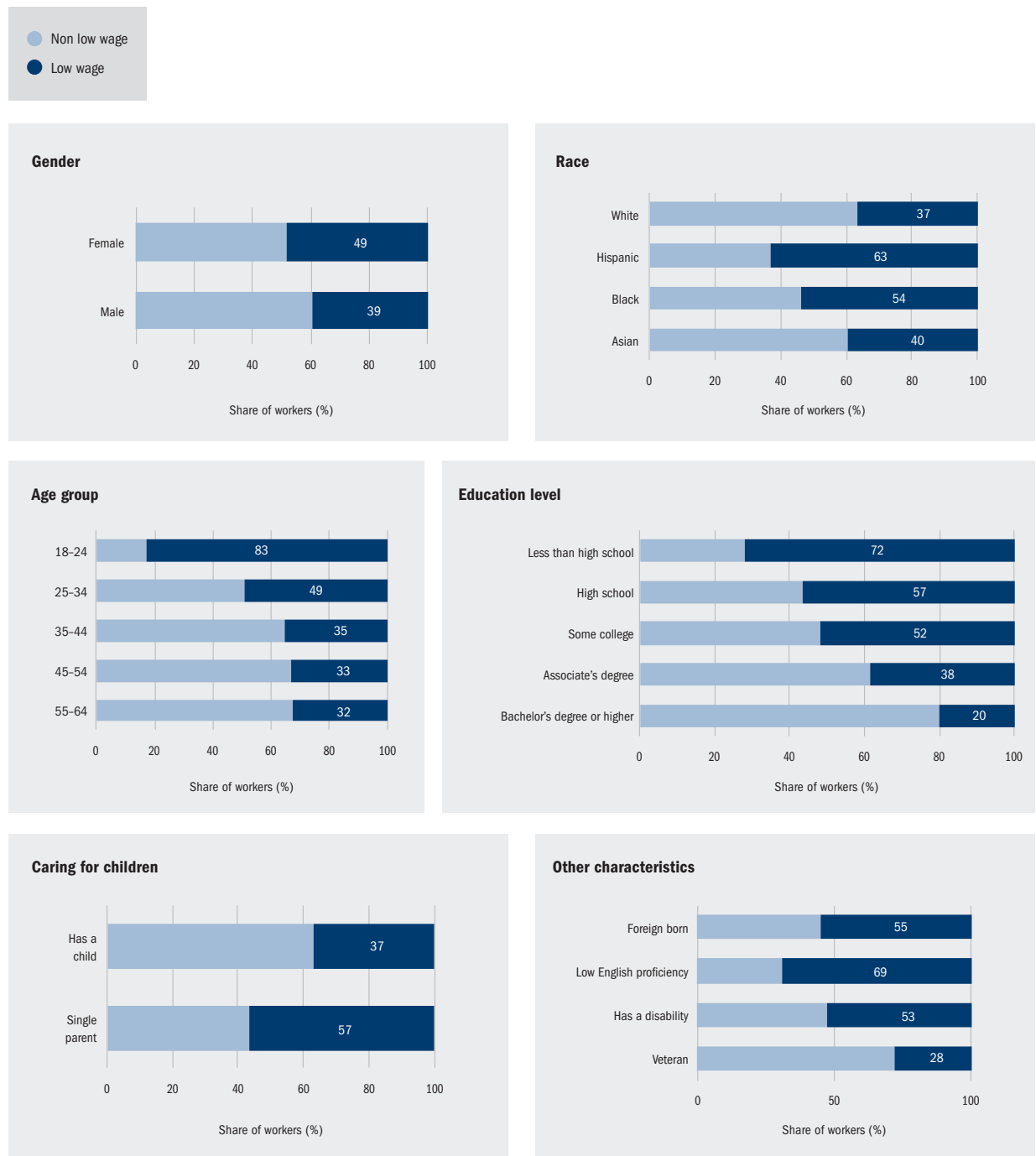
Unsurprisingly, the largest metropolitan areas have the highest numbers of low-wage workers: 3.5 million in the New York City area, 2.7 million in the Los Angeles area, 1.6 million in Chicago, and about 1.2 million each in Dallas, Miami, and Houston. Smaller metropolitan areas—such as Pine Bluff, Arkansas, Walla Walla, Washington, and Ithaca, New York—have fewer than 15,000 low-wage workers (figure 2.3).

The number of low-wage workers relative to the total workforce tells us where the concentration of low-wage workers is particularly high or low. Low-wage workers account for 44 percent of all workers nationally, but that figure varies substantially by place. Across more than 300 metropolitan areas, the share of workers earning low

* The terms "white" and "Black" are used throughout this report to refer to non-Hispanic, white-identifying individuals and non-Hispanic, Black-identifying individuals, respectively.

FIGURE 2.2

Low-wage work is more prevalent among some demographic groups than others

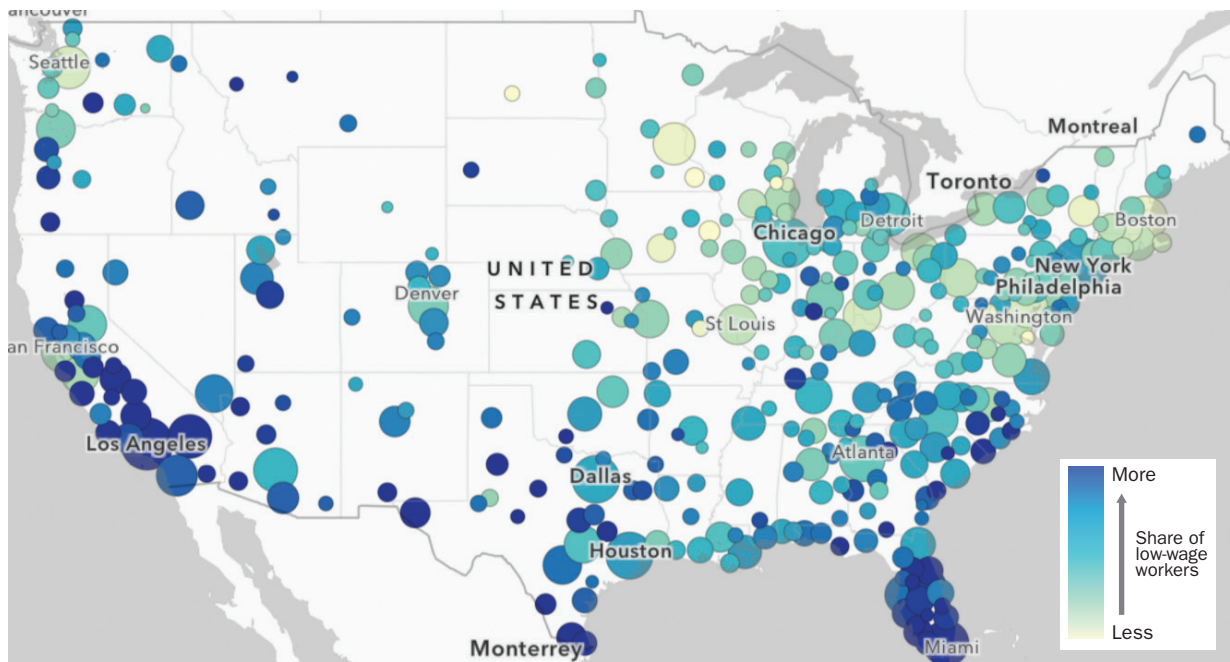


Source: Brookings analysis of American Community Survey data (2012-2016).

wages ranges from a low of 30 percent to a high of 62 percent. Even though smaller places in the southern and western parts of the United States have smaller numbers of low-wage workers than

the largest metropolitan areas, they have low-wage workers making up a high share of the workforce. Some examples are Las Cruces, New Mexico, and Jacksonville, North Carolina (both

FIGURE 2.3

Distribution of low-wage workers by metropolitan area

Note: The size of each bubble represents the population of its respective metropolitan area.

Source: Brookings analysis of American Community Survey data (2012-2016).
Interactive map at <http://www.brookings.edu/research/realism-about-reskilling>.

with low-wage workers making up 62 percent of the workforce), Visalia, California (58 percent), Yuma, Arizona (57 percent), and McAllen, Texas (56 percent). On the other end of the distribution, many of the places with the lowest concentrations of low-wage workers are in the mid-Atlantic, Northeastern, and Midwest states, such as the community of California, Maryland (30 percent), Rochester, Minnesota (31 percent), Bismarck, North Dakota (32 percent), and Hartford, Connecticut (32 percent).

While cities with more complex or advanced economic activities tend to have higher median wages, they also have higher shares of low-wage workers.³ We interpret this finding to mean that complex industries that bring high-wage jobs, such as financial and information services, also create demand for low-wage industries, such as restaurants and retail, while driving up costs of living. Another explanation is that some cities are more attractive to live in than others due to the amenities

they offer, such as warmer weather, culture, social services, or other features. People might be willing to accept lower real wages to live in these places, increasing their share of low-wage workers.⁴

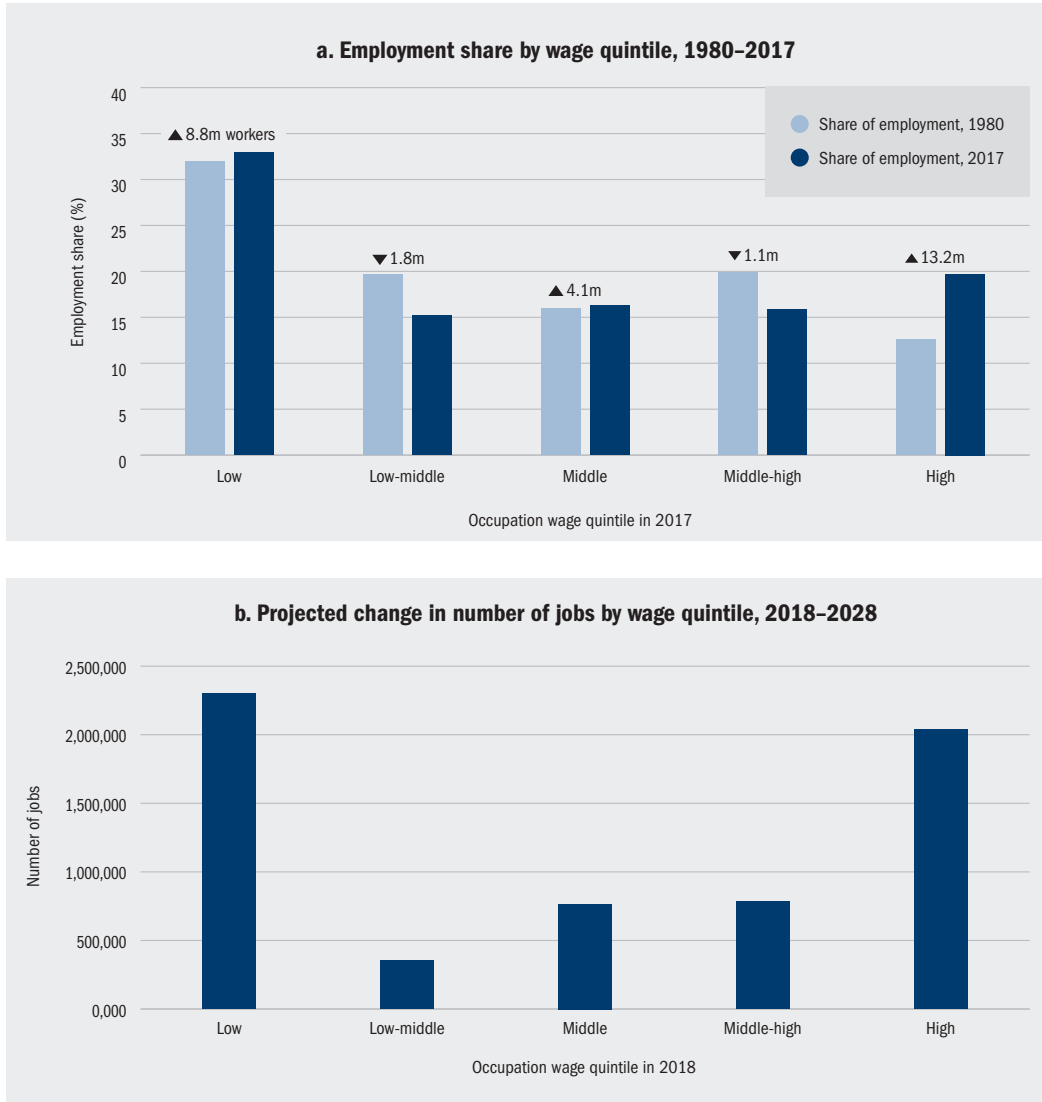
The data at hand make it hard to conclusively judge all the determinants behind the share of low-wage populations. However, we find that complex industries are associated with a higher share of people participating in the workforce, suggesting that employment opportunities for the low-skilled may grow in high-complexity environments. So cities should likely couple their efforts to host complex industries with proactive policies supporting wages, upskilling, urban transport, affordable housing, and improved job quality within firms.

The continued growth of low- and high-wage work

Since 1980, the labor market has added jobs predominately in either high- or low-paying

FIGURE 2.4

Past trends and ten-year projections show the continued erosion of the American middle class



Note: To compare employment shares of each occupation from 2017 ACS to 1980 Census data, we used the crosswalk created by Autor and Dorn (2009). The shares of employment for 1980-2017 are calculated based on a subset of 305 occupations.

Source: Brookings analysis of Bureau of Labor Statistics data (2018-2028), American Community Survey data (2017), and Census data (1980).

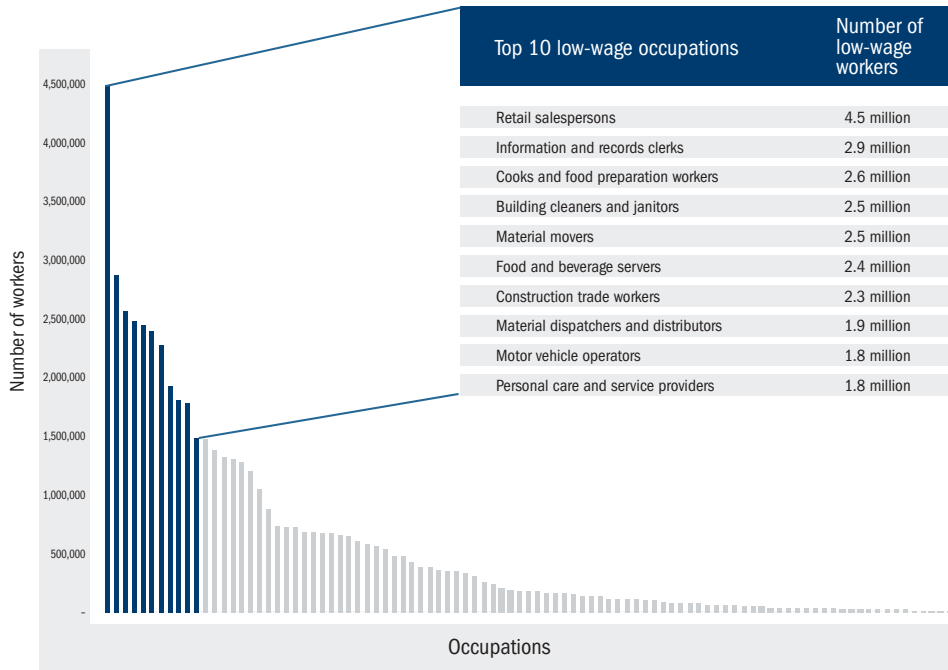
occupations.⁵ Our analysis of Bureau of Labor Statistics (BLS) data shows that the nation can expect this bifurcation trend to continue (figure 2.4), due to some of the forces outlined in chapter 1.

Nearly half (47 percent) of low-wage workers work are in just 10 occupational groups (figure

2.5). In total, they include about 25 million low-wage workers. Retail sales workers make up the largest share—8 percent of all low-wage workers, or 4.5 million people. Other common occupations include information and records clerks, cooks and food preparation workers, and building cleaners and pest control workers—each with more than 2.5 million low-wage workers.

FIGURE 2.5

Top 10 occupations held by low-wage workers



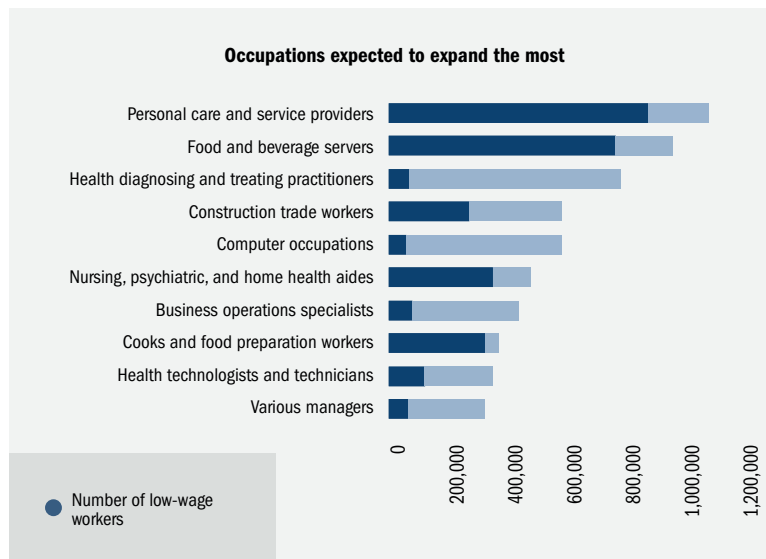
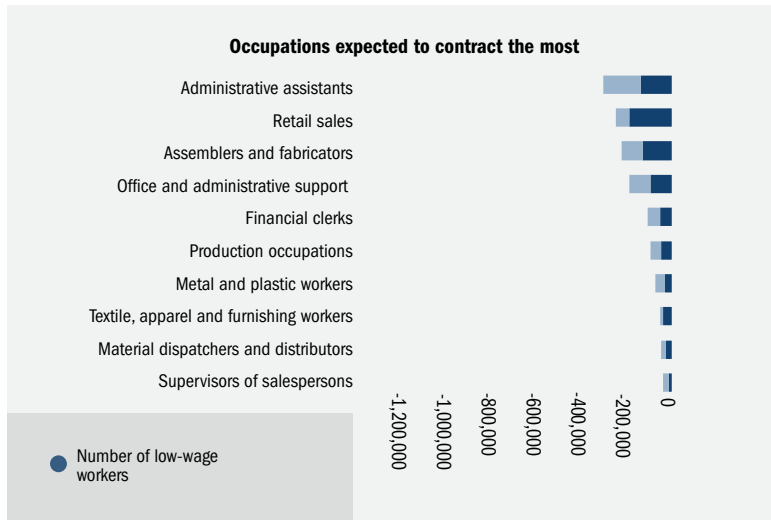
Source: Brookings analysis of American Community Survey data (2012-2016).

Most of these major low-wage occupations are expected to grow between 2018 and 2028 (figure 2.6). The numbers of cooks and construction

workers are expected to grow the most, at 11 percent each.⁶ The only occupation in the top 10 projected to shrink is retail work (-2 percent).

FIGURE 2.6

The top occupations expected to grow and contract will increase low-wage work while also displacing many low-wage workers (2018-2028)



Note: Low-wage workers make up a significant portion of employment in the top 10 occupations expected by BLS to grow and contract. Low-wage employment will continue to grow, though job losses will displace many. The figure assumes a constant share of low-wage workers in each occupation over time.

Source: Brookings analysis of Bureau of Labor Statistics data (2018-2028) and American Community Survey data (2012-2016).

CHAPTER 3

Job transitions and opportunities for mobility

Accelerating technological change is transforming jobs, workplaces, and careers. Low-wage workers tend to be more vulnerable to these shifts, and workforce development programs are generally not designed to meet their needs. Workers could benefit not only from user-centered reskilling organizations, but also from forward-looking guidance on labor market opportunities, tailored to their existing skills and experience.

Customized information can help job seekers either narrow their options when possibilities are overwhelmingly numerous or expand their options when possibilities are narrow.¹ Similarly, locally relevant, forward-looking labor market information can help reskilling organizations adapt their programs to the local workforce and to future market trends. Workforce development interventions are most successful when they are tied to labor market demand and industrial sector strategies.²

Tailored and empowering information will take at least three factors into account. First, it will anticipate local demand for specific occupations. As noted above, errant training programs detached from labor market opportunities can be especially detrimental to low-wage workers. Second, it will account for workers' existing skills and previous experience to suggest realistic opportunities for upward transitions. Third, it will empower rather than restrict. That is, information should enable workers to make the best possible decision for themselves rather than funnel them into a career based on outdated trends and individual characteristics (such as, if you are good with people, retail is the right occupation for you).

Big data offer no silver bullet, and predictions should be taken as guidance rather than fate. But

abundant information is available to be analyzed and synthesized to help workforce development organizations see around the corner and improve outcomes.

This chapter characterizes low-wage occupations and worker transitions from one job to another. It then details an approach to tailor information at a local level to guide and link economic and workforce development systems.

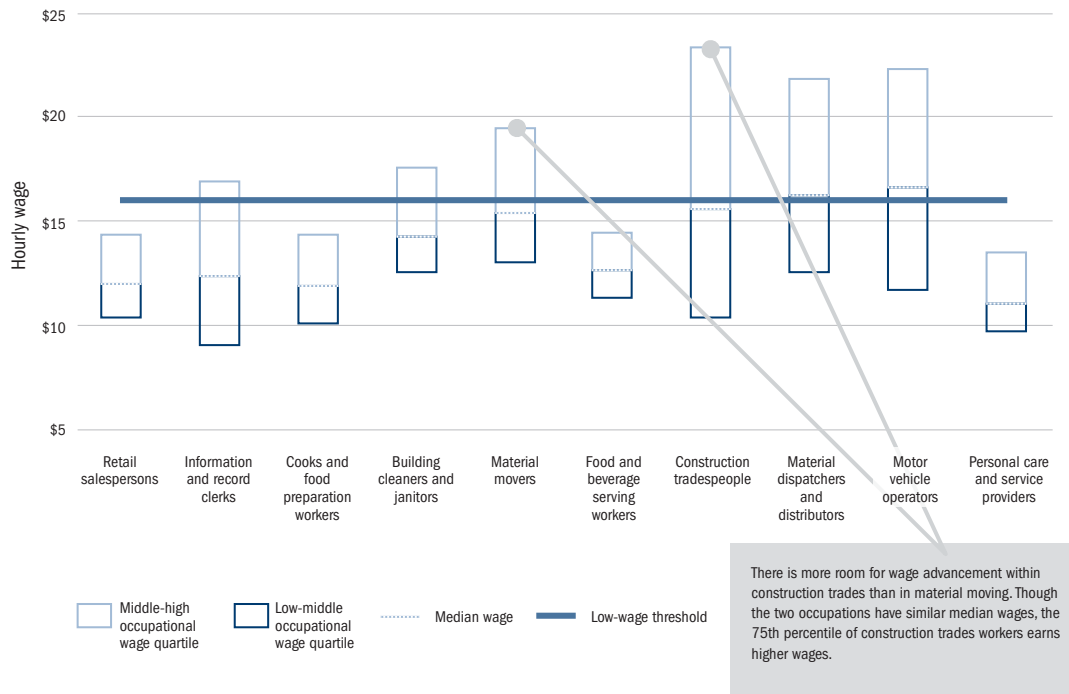
Whether staying in an occupation or switching to a new one, opportunity is lower among low-wage workers

Prospects for mobility among low-wage workers are dim

Most low-wage workers, concentrated in a handful of occupations, have low prospects for mobility within them. Three-quarters of workers in retail sales earn low wages. The distribution of wages is similarly skewed to the low end for cooks, cleaners, and hospitality service workers. More than half of workers earn low wages in every one of the 10 most common low-wage occupations outlined in chapter 2. And in 34 occupations (of 96 broad occupational categories), more than half of the workers earn wages below the low-wage threshold. These low-wage occupations cover

FIGURE 3.1

Remaining in some occupations offers little promise for wage growth



Note: Within the 10 occupations that employ the most low-wage workers (descending left to right by the number of low-wage workers), there is different opportunity for mobility.

Source: Brookings analysis of Occupational Employment Statistics (2018).

more than 35 million low-wage workers, or two-thirds of all those identified as low-wage workers. Within these occupations, even workers who demonstrate their value to their employer face a workplace structure where most employees are paid a low wage. These workers will almost certainly need to switch occupations to earn higher wages.

And low-wage workers tend to have worse outcomes in the labor market. For starters, they find stable employment relatively hard to come by. They tend to “churn” through the labor market more often than those who work for higher wages. That is, they tend to switch often between employment and unemployment. This contributes to increased income volatility and financial instability and reduced financial well-being.³ Workers who earn lower wages also tend to stay unemployed for a longer time following a job loss.⁴

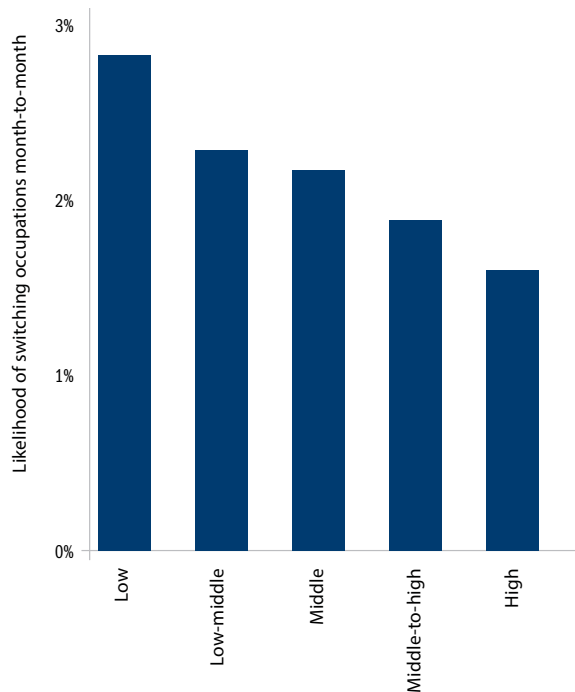
This trend of unpredictable earnings has been increasing since the 1970s.⁵

Unsurprisingly, the most promising labor market moves are job-to-job transitions. Those who switch immediately from one job to another tend to earn more than those whose job change involves a period of unemployment.⁶ That is because people who search for a new job while employed generally do so from a position of relative financial security and therefore demand higher wages than they would if they searched from a position of unemployment.

But even in job-to-job transitions, mobility is restricted for low-wage workers. Data from the Census Current Population Survey reveal two key findings about the job transitions workers made between occupations since 2003. First, low-wage workers tend to switch between occupations more

FIGURE 3.2

Low-wage workers switch occupations more frequently



Note: Workers in lower-paid occupations tend to switch to other occupations more frequently. Over a month, nearly 3 percent of workers in the lowest wage quintile switch to another occupation. Some of these transitions reflect upward moves, but others disproportionately reflect lateral or downward moves.

Source: Brookings analysis of transition data from the Current Population Survey (2003-2019) and wage data from the Occupational Employment Statistics (2018).

often (figure 3.2). Second, they have less wage mobility than higher wage earners (figure 3.3).

A contributing factor to low-wage workers switching occupations more often may be that they are disproportionately younger and still trying to choose a career. In this sense, job transitions allow for more efficient labor market matching as workers voluntarily transition to occupations that suit their interests and skills. That is also why the rate of job-to-job transitions rises when the economy is doing well—people have more opportunities to find employment that matches their skills and lifestyles.⁷

However, people tend to become more productive and earn higher wages the longer they stay

in a job.⁸ Among low-wage workers, this happens less, and for many, pay raises within their occupation are not large enough to move them above the low-wage threshold (see figure 3.1). In understanding how labor market dynamics affect low-wage workers, the distinction is important between transitions sought from a position of financial security, which are better suited to a worker's skills and aspirations and offer higher wages, from those that are accepted reluctantly or out of necessity and offer little benefit.

Low-wage workers churn within a set of low-wage occupations

Workers' current wages are usually similar to the wages they received in their previous occupation. A career progression generally implies transitions into higher paying occupations. Yet the opportunity for mobility through job-to-job transitions is skewed.

When workers who earn wages in the low-wage quintile switch occupations, they have the highest likelihood of any wage group to remain in the same wage quintile and not to see any meaningful wage mobility (figure 3.3). Those in the low-middle quintile have a 55 percent chance of moving laterally or downward. Even those in the middle quintile are more likely to transition into an occupation that pays a lower wage than into one that pays higher wages. Rather than progress in their careers, low-wage workers are more likely to churn within a set of low-wage occupations.⁹

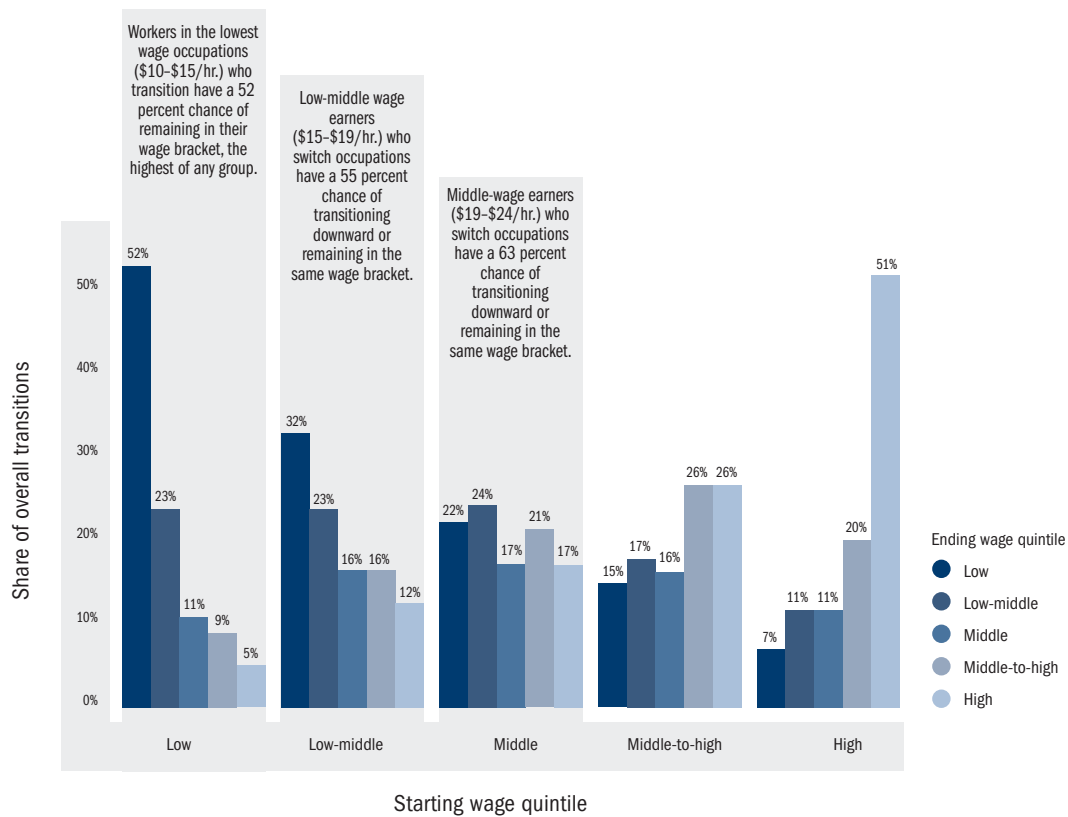
Characterizing job-to-job transitions and near-term mobility

To study the prospects of each occupation to deliver mobility, we create two measures:

- A job-to-job quality indicator classifies every transition as upward or downward, given a starting occupation.
- A near-term occupation mobility index classifies each of the 440 occupational categories.

FIGURE 3.3

Many low-wage workers transition from one low-wage job to the next



Note: The figure groups workers who switch occupations into five wage categories based on median earnings. For each group, it shows the likelihood of transitioning into each wage group in the next month, based on the starting position. It shows that low-wage workers are disproportionately likely to remain in their current position or transition downward.

Source: Brookings analysis of Current Population Survey data (2003-2019) and Occupational Employment Statistics data (2018).

It classifies whether workers leaving a certain occupation are likely to earn wages in their destination occupation higher or lower than workers leaving a different occupation with a similar wage. For example, among similar low-wage occupations, retail workers (at a mobility index 0.6) have a higher chance to earn higher wages when they transition than cooks (-0.7). On the higher end of the wage scale, while manufacturing sales reps earn similar wages as credit analysts, the former transition to higher-paying jobs (figure 3.6).

Defining the job-to-job quality indicator

Workers who transition from the lowest-paid occupations necessarily move to a higher-paid one.

We want the indicator to classify as upward only transitions likely to represent a meaningful pay increase. For each occupation (of 440 used in this analysis), we calculated the expected wage¹⁰ of workers, given that they switch occupations. This expected wage on transition is calculated by measuring the median wage differential for each transition in the historical data, giving a distribution of transitions with a mean and a standard deviation. Upward transitions are those that represent pay increases above this expected wage.

For example, the data show that a worker who leaves a job in food preparation work, which typically pays a wage around \$11.41 per hour, can expect to move into a job that pays, on average, \$11.55 per hour. We classify any transition from

food preparation work into an occupation with median wage higher than \$11.55 as an upward transition, since it reflects a job change with a wage premium higher than the average transition out of food preparation work. In the subsequent graphs, blue transitions are upward, orange are downward, and yellow reflect a return to the starting occupation.

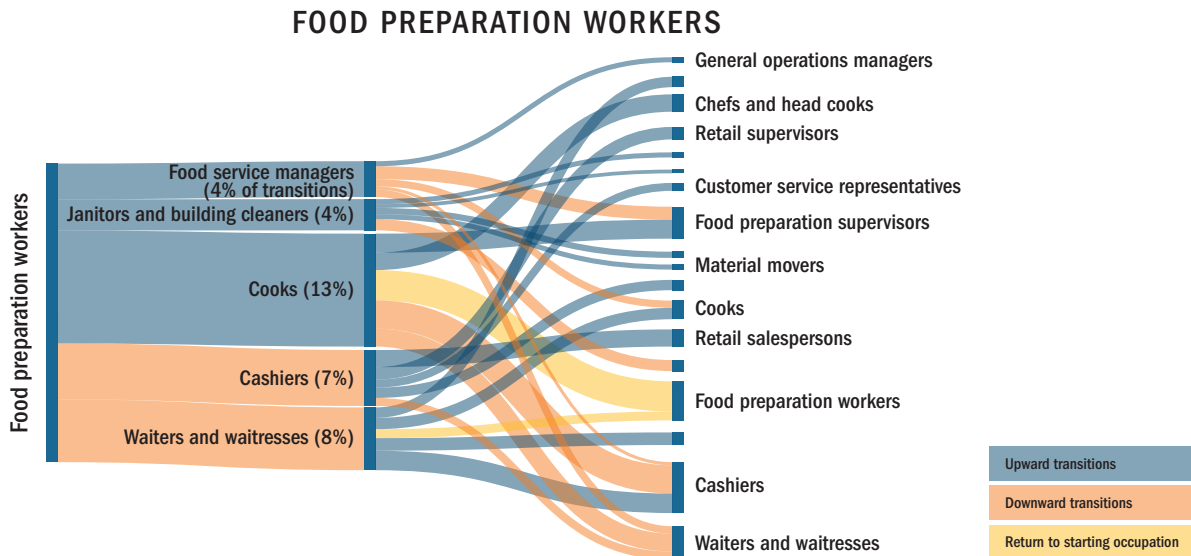
Figure 3.4 shows only the five most likely occupations, so many more are available. Using the distribution for each occupation, we can state how many standard deviations each transition is from the mean transition of individuals in the occupation. A move to food service management is more than two standard deviations above this mean in terms of salary, which is an unusually high jump (\$11.41 per hour to \$26.08 per hour). This definition allows meaningfully comparable classifications of upward and downward transitions for

occupations at any wage level. Depending on the purpose, the upward threshold can be adjusted in terms of standard deviations from the mean. This type of information can support planning and evaluation of reskilling programs as they help individuals navigate upward transitions.

The relative likelihood to transition from one occupation to another reveals an implicit overlap between the skills each requires. This information may complement other analyses of skill similarity between occupations. For example, measuring characteristics such as the abilities, work values, skills, or knowledge of janitors and cleaners shows that the occupation is most closely related to other low-wage work such as dishwashing, housekeeping, and food preparation.¹¹ But the historical transitions of janitors and building cleaners show that their second most likely transition is into maintenance and repair work, a decidedly

FIGURE 3.4

The job-to-job quality indicator can help reskilling programs plan for upward and feasible career steps

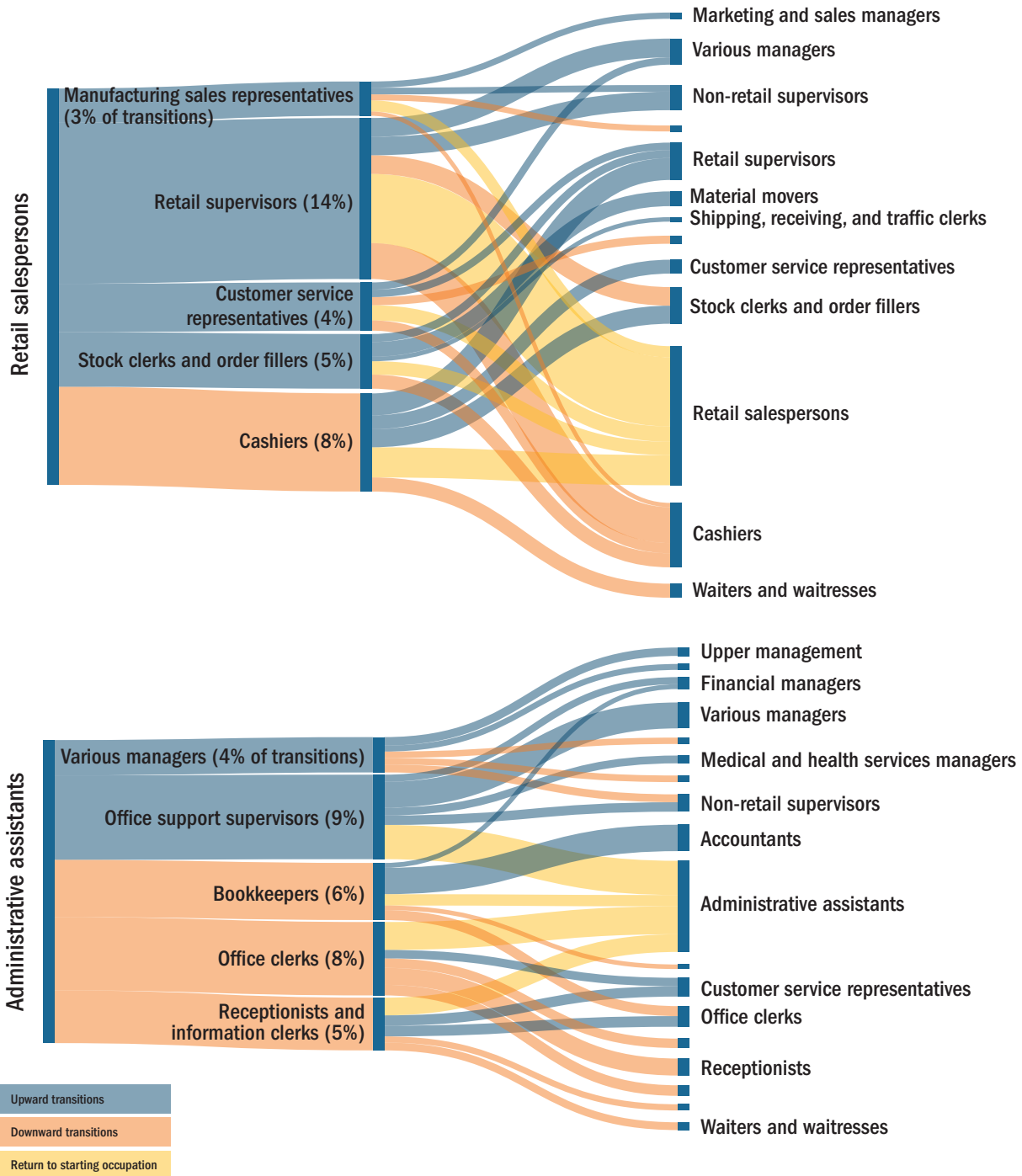


Note: The figure shows the five most likely destination occupations, and those occupations' likely destinations, for food preparation workers. The thickness represents the relative likelihood of each destination and the color represents moves into occupations that typically pay wages above or below the average wage someone departing each occupation garners in their destination. Blue transitions are upward, orange are downward, and yellow represent a return to the starting occupation. In each transition, the occupations are ordered from highest to lowest median hourly wage. The probabilities in the second transition are not conditioned on the first.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

FIGURE 3.5

It pays more to get promoted from some jobs than others



Note: The two-step Sankey diagram shows the relative likelihood (branch width) and trajectory (color) of the five most likely job-to-job transitions of retail salespersons and administrative assistants. Blue transitions are upward, orange are downward, and yellow represent a return to the starting occupation. The second step gives a sense of possibility of dramatic wage increases while also showing how disproportionately likely it is that workers will return to their starting occupation or otherwise transition downward to another low-paying occupation. The probabilities in the second step are not conditioned on the first transition.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

upward transition, and that neither dishwashing nor food prep is among the top five transitions janitors actually make. Proposing occupation transitions based only on similarity of skills is likely to miss transitions that are realistic and upward and runs the risk of improperly funneling janitors into other low-wage occupations.

Defining near-term mobility: Some occupations are more likely to translate to higher wages

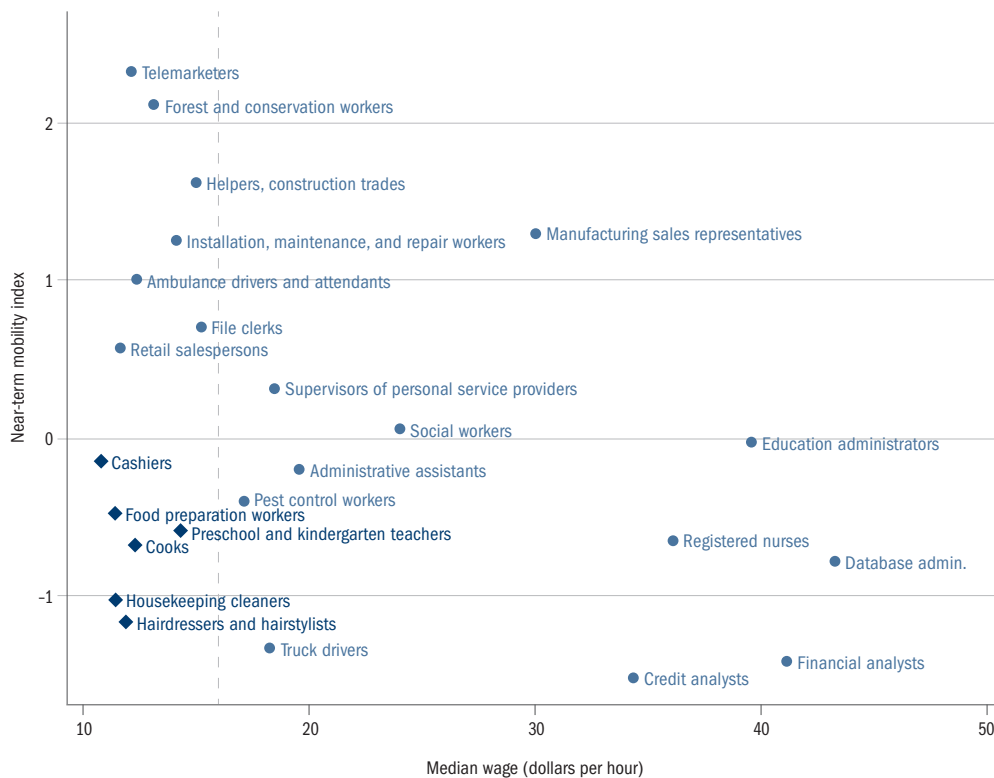
Workers transition to a broad range of occupational categories in a mix of promotions, lateral movements, and more significant career changes. Comparing the five most likely transitions of retail sales and administrative assistants (figure

3.5) gives the sense that prospects for workers leaving retail sales are better than for those leaving administrative assistance. Most retail workers' top five transitions are upward, whereas most administrative assistants' are downward.

To develop a measure of near-term mobility for workers departing a given occupation, we again note that at the lower wage limit, any transition is necessarily upward and that the reverse is also true. To estimate the quality of transitions available from a particular occupation, the analysis controls for what an average transition from a starting wage would be, then estimates whether individuals departing a particular occupation do better or worse. For instance, telemarketers tend

FIGURE 3.6

The most vulnerable workers are in low-wage, low-mobility occupations



Note: To estimate the near-term mobility from a particular occupation, we measure the average transition from a starting wage, then estimate whether workers departing the occupation in question do better or worse. For instance, telemarketers tend to transition to a much higher destination than would be predicted based on their current wages. The plot shows only a selection of occupations. Workers in occupations toward the bottom-left of the plot are the most vulnerable; their occupations pay low wages and may offer little opportunity for advancement. The dashed line references the low-wage threshold at \$16.03 per hour.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

to transition to much better paid destinations than would be predicted based on the wage they are currently receiving (figure 3.6). Because this calculation is expressed as a deviation from the expected transition, it can be compared productively across the occupation scale. This is called the “near-term mobility index.” For more detail, see methods in the appendix.

Applying transition measures in designing workforce and economic development to expand jobs that provide upward mobility

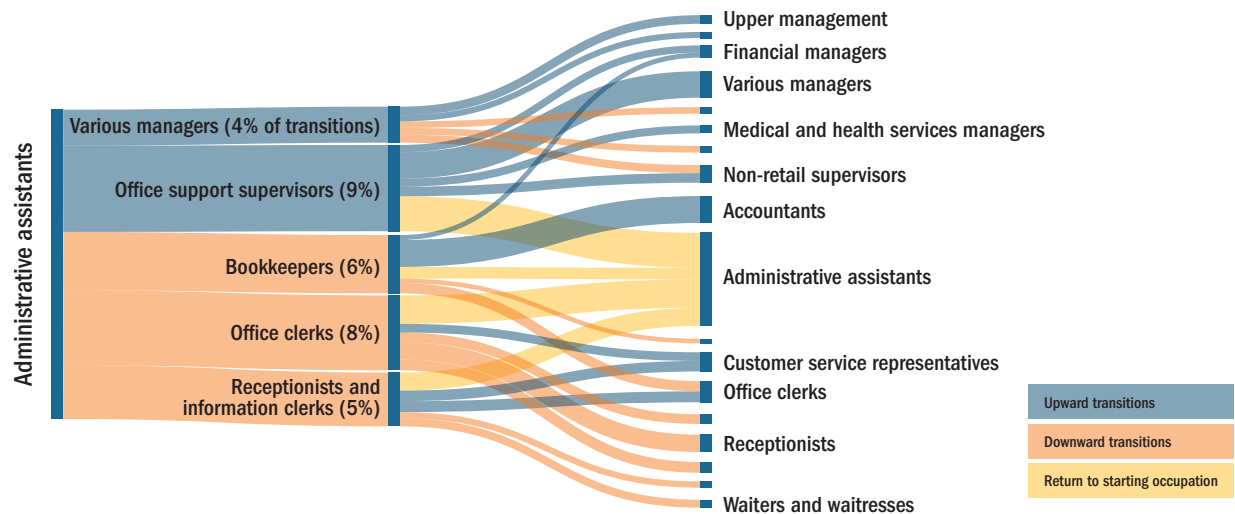
Low-wage workers’ tendency to transition downward or laterally underscores the need for policymakers to specifically target them. Support organizations might focus on workers in occupations that earn low wages with little opportunity for pay raises, as well as those in occupations that may pay higher wages but are likely to shrink

in numbers. Data can identify potential destination occupations that offer higher wages, increased mobility, and likely growth to better meet workers’ needs. Workforce development is most effective when tied to local labor market demand and when career moves are feasible and realistic.

Take administrative assistants (figure 3.7). That occupation is expected to lose nearly 280,000 jobs by 2028, by Bureau of Labor Statistics (BLS) forecasts. This analysis shows that, with a near-term mobility index of -0.2, prospects for workers leaving the occupation are low compared to prospects of workers in other occupations that pay a similar wage. One of their likely destinations stands out as representing a meaningful increase in salary—4 percent of the time, administrative assistants transition into a management position, presumably in their field of previous experience. The BLS expects such management occupations to add more than 300,000 jobs by

FIGURE 3.7

Workforce development organizations can seize the few opportunities for upward mobility for administrative assistants, as their occupation shrinks



Note: The figure shows the five most likely destination occupations, and those occupations’ likely destinations, for administrative assistants, an occupation in decline. The thickness represents the relative likelihood of each destination and the color represents the trajectory. Blue transitions are upward, orange are downward, and yellow represent a return to the starting occupation. In each transition, the occupations are ordered from highest to lowest median hourly wage. The probabilities in the second step are not conditioned on the first transition.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

2028. Clearly not every assistant can make the transition, since there will always be fewer supervisors than assistants. But the data show that the transition is possible, which could encourage workforce development organizations to make efforts to facilitate it.

Comprehensive local growth strategies start with people

Though some occupations are projected to grow or dwindle nationwide, regional variation is key. To support workers, state and city policymakers must anticipate local labor market trends.

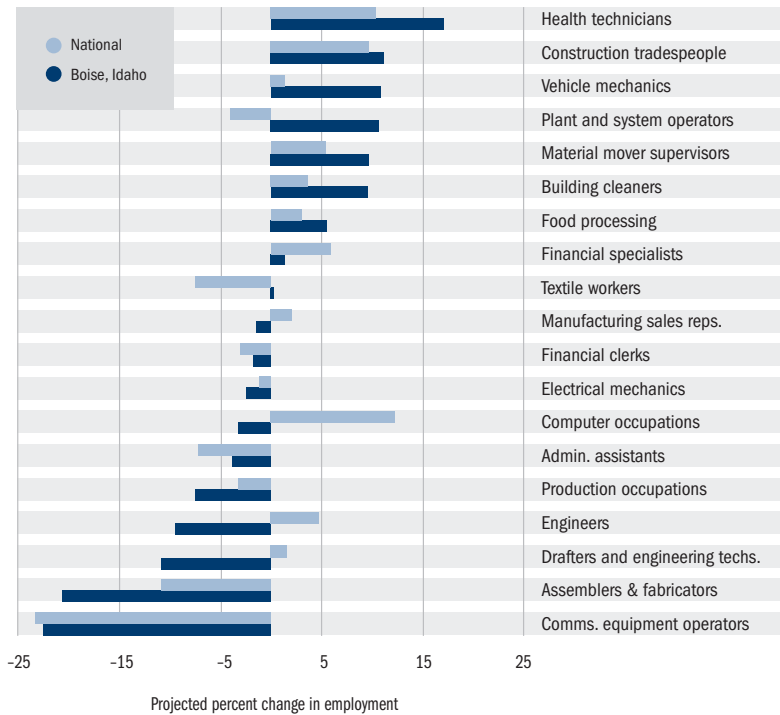
The Brookings report, *Growing Cities that Work for All*, shows that the industrial evolution of cities is path-dependent: Future growth depends on

existing capabilities, such as broadband, transportation infrastructure, the regulatory environment, and—most relevant to this report—local talent. Cities need to consider the workers they have, provide opportunities for them to prosper, and build and attract new high-skilled talent for complex and advanced industries to grow.

Projections of the growth and decline of a city's industries and the consequent growth and decline of occupations must incorporate local changes in staffing patterns. For example, the oil and gas extraction industry in Houston, Texas, engages in operations, research, and administration and accordingly employs a disproportionate number of financial specialists, engineers, and executives. The same industry in Farmington, New Mexico, is largely engaged in actual extraction and

FIGURE 3.8

Projections of local growth and decline of occupations in Boise, Idaho, vary from national projections



Note: Boise, Idaho uses network-based predictive methods to predict cities' growth patterns, further explained in *Growing Cities that Work for All*.

Source: Brookings analysis of Bureau of Labor Statistics (2018-2028) and Emsi data. Projections for Boise are based on methodology in an earlier publication (*Growing Cities that Work for All*). See methods 2 in the appendix.

therefore employs a larger share of extraction workers and plant operators. The national growth or contraction of the industry would pose vastly different occupational employment changes in the two cities. Similarly, changes in an industry's staffing requirements due to automation, trade, or changes in business practices will have different local effects since some occupations may be more or less susceptible. For example, if new technology further automates oil extraction then employment in Farmington, New Mexico would be impacted more than in Houston, Texas. For more details on metropolitan-level occupational employment estimates, see methods in the appendix.

Local considerations lead to forecasts that do not always mirror national ones (figure 3.8). For example, BLS expects about 200,000 assembler and fabricator jobs to be lost nationwide by 2028—about 10 percent of the total. But in Boise, Idaho, given the industrial structure of the city and given the location-specific staffing patterns of the relevant industries, the projection is more pernicious. Our analysis projects that the city will lose about 950 of those jobs in the next 10 years, representing a 20 percent decrease in Boise's assemblers and fabricators. Yet whether lost or retained, 58 percent of those workers are employed in low-wage work, according to our analysis of American Community Survey data. So, workforce development agencies could design programs with these individuals in mind, given that they likely have a shared set of skills that can be effectively redeployed into the labor market.

One likely transition for assemblers and fabricators is into a computer occupation, such as a network and computer systems administrator. Nationally, this is a growing occupation with a higher average wage, expected to add about as many jobs as the assemblers' occupation is expected to lose. Facilitating this transition would clearly require upgrading skills, but, according to our data, it is possible.

Understanding how industrial shifts affect occupations presents an opportunity for economic and workforce development branches of local government to work in concert. Economic developers might incentivize industries that employ workers in occupations expected to recede and industries into which workers might easily transition. On the flip side, workforce development officials might design programs oriented to the occupations and skills present in the local workforce, to build the human capital required by the industries expected to beget future economic growth.

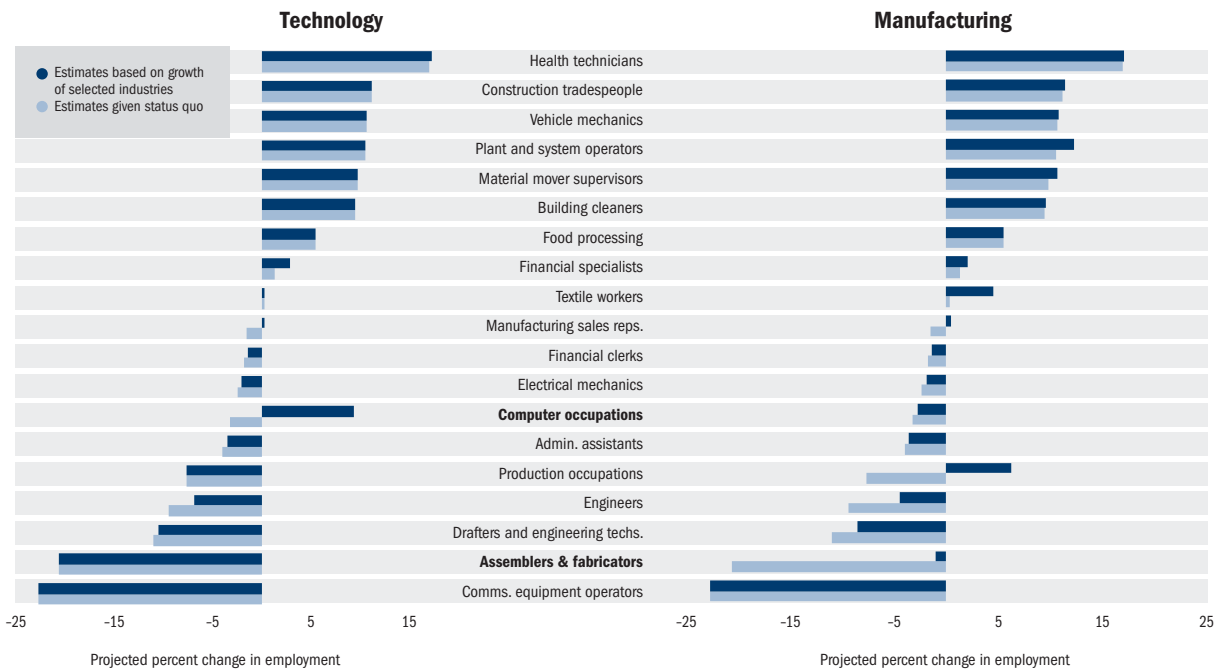
For example, in Boise the density of tech industries and of the other industries typically found alongside them has decreased (see *Growing Cities that Work for All*). As a result, both kinds of industries are predicted to shrink in the city over the next 10 years, so employment in such computer occupations as network and computer systems administrators is expected to contract, a stark contrast to national expectations. The city faces a chicken-and-egg problem: to attract such industries as software publishing, Boise needs a concentration of computer systems analysts, software developers, database administrators, and so on. But to attract that talent, or for locals to build those kinds of skills, the local software publishing industry must be hiring.

An economic development program might try to solve this problem with a two-pronged strategy. First, court related tech industries (such as software publishing, data processing, and scientific research and development). Second, build the requisite human capital. The left side of figure 3.9 shows how city leaders might expect employment to change if the city were to see growth in those three technology industries.¹² Note the expected percentage point change in growth in computer occupations (12%) - an occupation that is otherwise expected to shrink.

Filling a projected talent gap efficiently may include facilitating job transitions for workers

FIGURE 3.9

Investment in strategic industries ripples through local job markets



Note: The figure shows how the robust presence of certain industries can affect projected occupational employment at the local level. On the left, we project the occupational needs of Boise, Idaho, if it were to increase its competitiveness in technology industries: software publishing, data processing, and scientific research and development—and on the right in some manufacturing industries: beverage, chemical, plastic product, audio and video equipment, electrical equipment, motor vehicle, and medical equipment manufacturing. People are currently employed in these industries, but not at levels comparable to those in the rest of the country. We use a threshold of RCA (revealed comparative advantage) = 1 to model that the industry has a robust presence in a city.

Source: Brookings analysis of Bureau of Labor Statistics (2018-2028) and Emsi data. Status quo projections are based on methodology in an earlier publication (*Growing Cities that Work for All*). See methods 2 in the appendix.

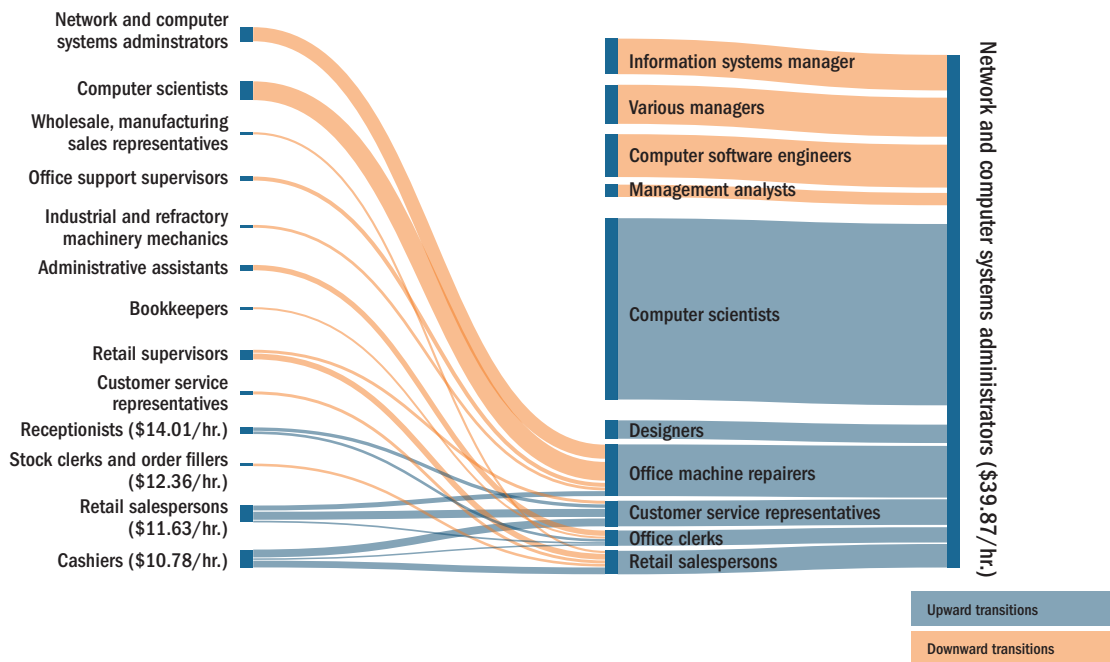
leaving occupations expected to shrink that frequently transition into the target occupation. Our analysis suggests two origin occupations likely to transition into network and computer systems administration (figure 3.10). Both office clerks and computer and office machine repairers are in occupational groups (financial clerks and electrical mechanics, respectively) expected to decline both nationally and in Boise (figure 3.9). But both occupations are somewhat likely to transition into network administration (as are assemblers and fabricators, for whom network administration is the 15th most likely destination occupation). The historical transitions of individuals between these occupations reveals an implicit skill overlap between the occupations and, most important, a plausible transition. Though the transitions identified may not be the most likely for those origin

occupations, empirical data shows they are possible. That should encourage reskilling organizations to facilitate them, especially when a broader strategy is being designed or when job losses in those origin occupations are anticipated.

Depending on the priorities of local communities, a more utilitarian workforce and economic development strategy might focus on alleviating employment losses expected in middle-skill manufacturing occupations. The right side of figure 3.9 shows the shifts in employment Boise could expect if it hosted a set of manufacturing industries chosen to provide good jobs or to employ people in occupations otherwise expected to recede over the next 10 years: beverages, chemicals, plastic products, audio and video equipment, electrical equipment, motor vehicles, and medical

FIGURE 3.10

Actual transitions suggest where to target to lift low-wage workers



Note: The figure shows likely routes network and computer systems administration, an occupation demanded by firms nationally and in localities such as Boise, Idaho. The historical transitions of individuals between these occupations reveal an implicit skill overlap between the occupations and, most important, present and plausible transitions based on historical precedent.

Source: Brookings analysis of Current Population Survey (2003-2019) and Occupational Employment Statistics data (2018).

equipment manufacturing. Such a strategy would try and buck national and local projections of receding employment in manufacturing, but successfully pursuing the strategy would be a boon to local low- and middle-wage workers.

The two examples—boosting tech and manufacturing—are not intended as prescriptions. They show how synthesizing data on job-to-job transitions, industrial forecasts, and local trends can give city planners a better understanding of the opportunities for the local workforce based on its current composition. In terms of practical implementation, one challenge is the misalignment of geographical purview of local economic and workforce development authorities. Without alignment through federal legislation, the onus will be on local leaders to find creative ways to incent cooperation. These methods can be used to outline strategies based on local

priorities and to identify opportunities for low-wage workers.

Engaging firms in reskilling for upward mobility

Firms are the site for most jobs, most career development, and where people's talent is transformed into goods and services for the world to consume. Creating better jobs, careers, and productivity requires firm-level action and involvement. Firms have a better understanding than any economic model of their talent requirements. They also host the highly specific knowledge that workers need to be productive and are therefore well-positioned to teach and reskill workers.

Cities that purposefully engage firms to build the capabilities required by those and related firms can foster resilient economic growth. Of the many capabilities that firms require to be competitive,

human capital is paramount, and it benefits from tight collaboration with a city's workforce and economic development strategy. Coordinated investments in increased reskilling can benefit the firm and its workers, while also expanding opportunity for low-wage workers.

In the long run, expanded opportunities grow the city's pie as the need to grow good jobs is not only a problem "of inequality and exclusion, but also a problem of gross economic inefficiency ... That is because a shortage of good jobs is associated with a significant range of public ills."¹³ Improving the quality of low-wage work can thus have spillover effects benefiting the broader society.

Such a mutually beneficial arrangement between firms and policymakers represents a compact in the provision of public goods. Firms reap the benefits of more productive labor, and communities benefit from a growing and robust economy. By building trust and broader agreement, policymakers can direct efforts toward firms' employment practices in pursuit of the parallel goal of shared growth, primarily by targeting the quality of low-wage work.

For example, a public-private framework could ramp up over time as trust builds. Voluntarily, firms could periodically disclose information about the job quality of their low-wage employees in exchange for public programs directed at training for hard-to-fill positions. The collaboration and dialogue alone are likely to have benefits. Employers that participate with civic organizations are more likely to solve collective problems such as skill shortages.¹⁴ Gradually, building on that information and trust, firms, labor, and policymakers could agree on a regulatory framework that reduces the economic inefficiency associated with low-wage work, improves on the status quo low-skill equilibrium, and benefits firms and workers alike.¹⁵ The next section describes how policy nudges and firm behavior can affect the quality of low-wage work, especially in the context of public-private collaboration. Job quality is

difficult to define and therefore difficult to regulate. But some innovative governance models and international examples can provide guidance.

Good policy and industry-level coordination in the United States

In reskilling, firms have an invaluable role. Particularly as the half-life of skills decreases with the increasing speed of technological innovation, firms are bound to have the most up-to-date knowledge. Indeed, the firm was the conduit for lifelong learning for many workers in the last century, since the ideal learning environment mixes learning and doing. Even with careers shifting more toward independent work, firms still host the know-how and give workers an opportunity to learn it in an applied setting. Accordingly, policymakers may consider encouraging skilling and reskilling inside companies as part of career progressions.

In labor markets where employees are likely to switch jobs and move from employer to employer (notably in the low-wage labor market), the private sector has had less incentive to invest in human capital. While there is evidence that investing in labor increases productivity, the relationship between investing in workers and profitability is harder to demonstrate.¹⁶ Businesses face significant up-front costs to improve job quality or provide training for their employees and do not have a straightforward way to quantify the return on investment for human capital, discouraging firms from taking on these investments. Though the extent of firm training is difficult to gauge, it has decreased in recent years as measured by share of employees receiving training.¹⁷

Policies and nudges can incentivize businesses to improve job quality for their low-skilled workers. Several states, including Virginia, Connecticut, and Georgia, experimented with providing tax credits to firms for disclosing their spending on human capital and labor, particularly the spending targeting their low-wage and low-skilled workers.¹⁸ These programs provided tax credits

ranging from 5 percent to 50 percent to cover firms' costs. In Connecticut, the study evaluating the tax credit system documented modest and positive productivity gains for participating firms.

Public-private work councils—local organizations that complement unions—encourage collaboration between firms, policymakers, and education institutions to move toward a more responsive education system, more apprenticeships, and increased investment by firms in the talent pipeline.¹⁹ Collaborative trust-building models with clear outcome measures could lead to innovative solutions. For example, potential public-private dialogues could reallocate responsibility for delivery of public goods from today's setup, in which workers' health care is typically financed by firms (in ways that are inefficient, expensive, mobility-limiting, and increasingly unavailable), but training is increasingly outsourced to reskilling organizations (which are necessarily less nimble than firms in responding to market needs).

International examples of innovative solutions and public-private collaboration

International examples can inspire homegrown solutions. Some of the examples here involve generous government or firm-level investments in worker training, but all involve public-private collaboration.

- In Sweden, many workers are covered by Job Security Councils, non-profit organizations funded by a 0.3 percent payroll contribution from participating employers.²⁰ These councils operate as an insurance scheme, providing transition services to workers, including financial support for retraining, in the case of a collective redundancy.
- In Germany's dual vocational education system, students combine theoretical training in publicly funded vocational schools with employment in a company several days each week.²¹ Programs usually last two to three

and a-half years, and students are paid a salary by the company as they complete the course. Employers and trade unions jointly develop and update the regulations for the 330 occupations that require formal training so that training is standardized, valuable for students, and credible for employers.²²

- In France, companies with more than 10 employees contribute 1.6 percent of their payroll costs.²³ Workers have the right to receive training funded by these contributions managed through a personal training account. This has led to the growth of innovative skilling provider firms, accredited on the basis of employment outcomes, that court workers and compete for training funds. The account remains valid throughout worker careers even if they change employers, and includes both self-employed and regular employees.²⁴
- In Singapore, firms have access to a range of government funding schemes to cover up to 90 percent of the costs of employee training, with specific programs targeted at low-income workers over age 35 and small-to-medium enterprises.²⁵ In addition, the government oversees the Workforce Skills Qualifications system, a set of nationally recognized training options and credentials focused on competencies needed in the workplace.²⁶

From training to job quality: The case for investing in workers and good jobs

Good jobs provide adequate pay, training, performance standards, and better career paths. Companies can restructure their operations to ameliorate the work conditions and enhance the skills of their employees, increasing worker motivation, productivity, and sense of commitment and ownership in return. The firms that empower their employees are more likely to have higher customer satisfaction, which often translates to

the bottom line, expands a firm's ability to pay higher wages, and contributes to a virtuous cycle.

Creating good jobs and providing upward mobility, particularly to low-wage workers, requires a purposeful approach. In "The Case for Good Jobs," MIT Professor Zeynep Ton provides a compelling rationale and evidence for why and how to make the shift.²⁷ She notes that it requires a dramatic redesign of many traditional operating principles. Investing more in workers, particularly in low-margin businesses that often employ low-wage workers, may seem counterintuitive, but a host of case studies is starting to demonstrate how it is possible.²⁸

The case studies show that the path to better jobs requires a mix of strategies. Businesses that provide jobs to low-skilled workers—such as retail stores, restaurants, call centers, and day care facilities—can improve job quality by cross-training their employees to complete different tasks in the workplace and empowering them to make small decisions about their own tasks. These structural changes to jobs give workers a higher sense of commitment and ownership of their workplace. The outcome can reduce employee turnover and enable internal promotions, so that in a retail store or a call center with lower employee turnover, a new supervisor or store manager will more likely be promoted from within.

While Ton and others have compiled evidence of the return on investment for these practices, their effectiveness will vary by industry, region, and the firm's ability to implement change. Such efforts should be paired with thoughtful legislation that encourages firms to invest in this transformation, create career paths, and invest in workers as long-term assets.

Groups such as the Business Roundtable, an association of eminent CEOs, are trying to expand firm commitments beyond shareholders to a wider set of stakeholders, including workers. Yet these intentions will require both specificity and thoughtful legislation to meaningfully change firm-level

behavior and incentives. Leaving social outcomes to the platitudes and good will of firms is unlikely to create sustained improvements to the status of low-wage workers. Firms' willingness to experiment with strategies where investing in good jobs has long-term returns is key. But thoughtful regulation and enforcement mechanism creating a level playing field is the domain of public policy, so that all firms, not just the well-intentioned, will invest equally in workers.

A starting point could be improving the measurement of human capital management and publicly disclosing measures that track progress, such as training budgets, employee turnover by wage quartile, wage bills, contract workers as percentage of the workforce, the share of employees receiving benefits, and rate of internal promotions. These measures would help policymakers create incentives and track their impact and would help companies and investors track the effects of their investments in human capital.

Toward a higher equilibrium

Ultimately, companies are the engine of the economy and the locus of jobs. Positive social outcomes follow stable companies working with thoughtful government partners to create the rules that maximize welfare and spur innovation. Reaching a better equilibrium that sustains companies' long-term competitiveness and increases opportunity is likely to arise from two key motivators:

- **Firm-level strategies.** Better data and evidence could encourage firms to make strategic and operational changes to improve job quality, betting on a positive long-term return on investment through less turnover, more productive employees, and a more loyal and financially secure workforce. While companies are increasingly innovative and sophisticated in trying to retain and upskill high-skill talent, the opposite has been true for low-skill occupations, which have mostly been outsourced to third-party vendors. Given the

costs of high turnover and skills shortages, innovative retraining and upskilling lower-skill workers should be fertile ground for firms' new strategic considerations when planning for talent. Analyses like the one in chapter 3 (which can be replicated in-house with more specific, firm-level data) can help companies train for in-demand jobs with more certainty of success and could empower human resource departments to build more robust in-house talent pipelines.

- **Regulations or tax incentives to improve worker conditions.** At both the national and regional level, policymakers are looking for the right incentives to encourage firms to invest in workers and to manage the rapid rise of contract work. In some instances, thoughtful regulation can create a level playing field where all firms in a region or industry engage in similar investments to upgrade the talent pool (as with Apprenti, an initiative of the Washington State Technology Industry Association²⁹) or a more robust pipeline from K-12 or post-secondary education. Effective policy can employ other mechanisms such as targeted wage subsidies, tax incentives to encourage more apprenticeships and training, regulation that supports the rights of contract workers, portable benefits attached to workers rather than jobs, and mandated labor condition disclosures to capital markets. Incentives can also vary by firm size, since smaller companies are responsible for most U.S. employment and job growth but require help in acquiring and retaining talent.

The role of firms

Firms will take center stage in the country's efforts to meet the reskilling needs arising from rapid innovation. But equipping workers with skills and helping them land jobs will only do so much if firm-level practices exacerbate workers' economic precariousness. Instead, with the right nudges, firms can pair placement with efforts to improve job quality, provide training, and increase promotion opportunities among low-wage workers.

Firms strive to efficiently maximize profit while delivering value to customers. And rising inequality is partially a product of firms' efforts to optimize efficiency within a system of rules than can encourage economic growth without regard to workers' livelihoods. It is up to policymakers, collaborating with firms, to create rules of the game that support workers in turbulent transitions. These efforts don't always have to come at the cost of a business's bottom line—for example, the leaders of thriving companies are increasingly recognizing the returns to investment of raising minimum wages.³⁰

In addition, the current U.S. workforce development system and its fragmented, complex structure is difficult to navigate for companies. We need dramatic, new investment in reskilling infrastructure that provides an easy point of entry for companies, is responsive to market demand for skills, and is inclusive of low-wage workers, who are most vulnerable to displacement.

The next chapter introduces recommendations toward this goal.

CHAPTER 4

The user journey: Equal opportunity in lifelong learning

Given the flood of new workplace technologies, workers must continuously upskill and reskill to adapt to the changing economy. However, the odds are stacked against low-wage workers who are uniquely vulnerable to structural inequalities. In this section, we apply design thinking principles to theories and evidence of learning and adult education to imagine the features of educational systems necessary to better accommodate individuals who aspire to achieve upward mobility.

We identify a core set of friction points that workers encounter when seeking to reskill and give recommendations for how organizations can help mitigate them. These friction points constitute an “end-to-end reskilling journey” and include: Encouraging workers to enter the workforce development system; building self-efficacy; navigating careers and systems so skilling can translate into good jobs; assisting in dealing with economic and social barriers; providing good learning content and teaching that meets them where they are; and sustaining support throughout the journey beyond landing the next job (figure 4.1). Barriers in all these areas make the reality of reskilling more challenging for adult learners.¹

The education system today struggles to meet the needs of low-wage workers primarily because it is not designed with them in mind. Little research exists that follows these workers over time to understand their whole reskilling pathway.

To help fill this gap, we adapt methods primarily seen in design for consumer products but increasingly used in design of public services and explored in public policy and academic literature.² We offer the end-to-end reskilling journey as a working hypothesis of how adults experience learning, further enriched through an effort to accommodate the demographic challenges that are overrepresented among low-wage workers.

FIGURE 4.1

The end-to-end reskilling journey



We supplement the user journey with case studies from practitioners working to find solutions to friction points workers encounter along the way. We describe the components of their model, which may serve as an effective example for replication.

We pay particular attention to literature on nontraditional students, defined as students who “[are] at

least 25 years old, attend school part-time, work full-time, are a veteran, have children, have waited at least one year after high school before entering college, have a GED instead of a high school diploma, are a first-generation student, are enrolled in nondegree programs, or have reentered a college program.”³ This group now makes up the majority of learners in any sector of higher education, according to the National Center for Education Statistics.⁴

BOX 4.1

Isa’s journey

Isa’s journey is based on that of a real person. We retain her perspective throughout this section to highlight the friction points of low-wage workers who seek upward mobility.

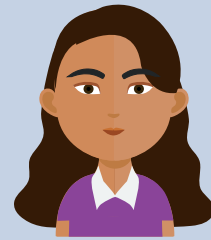
Isa is a 24-year-old Hispanic single mother of two, working diligently to provide a stable and dignified life for her family. She has worked continually since she was 16 years old and earned her high school diploma at 18. After starting work in the service industry, she transitioned to clerical support jobs, where she has worked for the past few years.

In her late teens and early twenties, the low-wage clerical support and service jobs did not prompt anxiety about her long-term economic prospects. After all, most people hold similar low-wage jobs before and during post-secondary education. As she has aged, however, she has considered returning to school to provide more for her family.

Isa is conscientious, detail oriented, and organized. She was promoted quickly at her previous jobs but never stayed with any employer long enough to attain a significant pay increase. She recently began working for a construction company, which prompted her to sign up for a real estate licensing course.

The \$700 course took place on Saturdays and Sundays for nine hours each day. Luckily, Isa’s mother was able to watch her children most of the time, though sometimes she had to hire a sitter. The classes were taught in a lecture format, and additional courses for remediation cost \$100 (Isa took one for math). Finding time to study while working full time and raising two kids proved difficult, and she

found herself falling asleep on weekend nights trying to cram more information after a full day of class and after a full week at work. In the end, Isa failed the final exam.



But Isa remains optimistic. She believes that, when she has more time to study, she will pass the exam and secure a promotion. Other than work in real estate, she is not sure there is much else she would rather do. While she once dreamed of becoming a marriage and family therapist or a crime scene investigator, she never fully understood how to make those dreams a reality. She was a decent student in high school, but she didn’t always see the link between what she learned and the eventual tasks she would perform at work.

Isa’s journey mirrors those of 53 million low-wage American workers. She is employed but makes less than two-thirds the national median salary. She is in a job at risk of dislocation and has insufficient technical skills to adapt to meaningful new jobs in the digital economy. At the same time, she has a character that disposes her to success. She is willing to work hard for her life and her family but believes that some structural support could go a long way.

Throughout this section, we draw on Isa’s journey to highlight the challenges faced by low-wage workers as they navigate the reskilling landscape, make decisions about their careers, and manage the challenges they face getting ahead in a changing economy.

We focus on these users because their needs are often overlooked or intentionally selected against, either because of design bias or because they are simply harder to serve than advantaged learners. But they are far from beyond reach—specific curricular, pedagogical, and system design techniques could be implemented to facilitate these workers' social mobility. Doing so is essential to any lifelong learning infrastructure that can absorb, retrain, and redeploy economically dislocated workers.

While our end-to-end reskilling framework is thoroughly informed by relevant academic literature, interviews with real users, and feedback from practitioners, it is not comprehensive. We hope our framework can be a starting point that can be further nuanced or challenged through targeted longitudinal research that follows users through multiple transitions after an intervention.

1. Encouraging user entry

Where do workers looking to reskill even begin? This simple question belies complicated truths about how and why adults pursue continued education, the push and pull factors that influence their choices, and the information asymmetries that can obscure their paths forward.

Isa signed up for the real estate course at the suggestion of her coworkers. There was no targeted marketing campaign that prompted Isa to sign up. Instead, her motivation came from word of mouth and her own initiative.

Renewed effort is needed to engage hard-to-reach populations

The first step in reaching low-wage workers is actively engaging their communities. Research points to strong peer effects for acquiring information, as most people rely on social networks.⁵ Increasing economic stratification and ossifying class structures have created environments where low-wage workers interact mostly with

"I wanted to go back to school for my kids and for my future. People at my work encouraged me."

—Isa



other low-wage workers.⁶ This limits their exposure to employment opportunities and the reskilling landscape.⁷ As one senior Goodwill Industries International mission leader recounted, low-wage Americans struggle to see themselves pursuing employment in the knowledge economy, in part because, "people like me don't do jobs like that."⁸

When it comes to reaching these low-wage workers, an "if you build it, they will come" approach is not enough. Yet most workforce organizations neglect advertising and marketing to the audiences that could most benefit. Little innovation has taken place to fill this void.

A recent study by MDRC, a policy evaluation firm, assessed Work Advance programs, a highly successful model of workforce development. MDRC found that recruitment costs made up between 4 and 6 percent of the total budgets across five workforce programs (with a sixth program spending 17 percent one year, a considerable outlier).⁹ Compare this with the Small Business Administration's recommendation that a business spend 7 to 8 percent of its annual revenue on marketing.¹⁰ The spending of workforce development organizations also compares poorly with those of consumer product companies, which typically allocate about 15 percent.¹¹

Marketing aside, word of mouth still dominates program recruitment. Of the organizations studied in the MDRC evaluation, three reported that more than a third of their recruitment inflows came from referrals by friends and family.¹² Among the most disadvantaged, social networks are smaller than those of the middle class or wealthy, and the longer an individual is poor, the

smaller their network becomes.¹³ So workers who earn low wages may find their networks, and especially their ties to wealthier workers and organizations, shrinking the longer they earn low wages.

Organizations should proactively recruit workers into the process of reskilling and lifelong learning. A 2018 report, “Invest in Work,” led by the Federal Reserve and other employment researchers, emphasizes this point. The authors state, “First, there are insufficient numbers of individuals being engaged in upskilling within the economy. In particular, efforts need to be taken to target existing workers and adults rather than relying on the traditional high school pipeline to help workers acquire those skills and fill those jobs.”¹⁴

Scrapping “one-size-fits-all” for a targeted outreach approach

Technology may amplify socioeconomic stratification when it comes to engaging lifelong learning. Among Americans with a college degree who report engaging with learning for professional advancement, 64 percent use the internet for at least some of it, compared with 40 percent of those without a college degree. Furthermore, a recent study found that 61 percent of adults

have little or no awareness of distance learning; 79 percent have little or no awareness of Khan Academy; 80 percent have little or no awareness of massive open online courses (MOOCs); and 83 percent have little or no awareness of digital badging, an emerging way to accumulate and communicate competencies gained using digital resources.¹⁵

At the same time, technology provides unprecedented capacity to target people looking to engage in lifelong learning. While analog social networks and exposure to stories of success in individuals’ own communities are most effective for diffusing opportunities, new technologies—like social media—have made it easier and more affordable for organizations to reach across social and economic strata.

But access to and use of different types of digital tools are stratified along socioeconomic lines. While low-income and non-low-income Americans use social media at roughly the same rates,¹⁶ the way users access the internet differs. For example, according to Pew, while 71 percent of low-income Americans making less than \$30,000 have a smart phone,¹⁷ a quarter of these users are “smartphone dependent,” meaning that their

BOX 4.2

Linking job search and retraining to more “sticky” interactions

In 2015, Jimmy Chen founded Propel Inc., a startup with a mission to leverage technology to build elegant and innovative solutions for those in poverty. The company developed a mobile application called Fresh EBT, which allows food stamp recipients to check the balance of their food stamps and access coupons and deals from stores that accept SNAP benefits.¹

Fresh EBT’s use has grown consistently since its 2015 launch, with more than 2 million SNAP users now participating every month. The majority of Fresh EBT users discover the app through word of mouth, while paid advertising attracts about 40 percent.

The app also includes a jobs board, which some 75,000 users have used to apply for jobs. Chen notes that “applying for jobs is not very sticky. For users to continually come back to an app or service, the engagement has to be sticky and meaningful. Managing a food stamp balance creates this stickiness—it is something that millions of people have to do many times a month.”

Like job applications, engaging with reskilling is not very “sticky.” As the Propel case highlights, reskilling organizations seeking to engage workers could benefit from partnerships with organizations that have repeated “stickier” touchpoints.

smartphone is their sole means of internet access.¹⁸ Program and technology designers ought to incorporate a “mobile-first” mindset to target these users.

Considering demographics

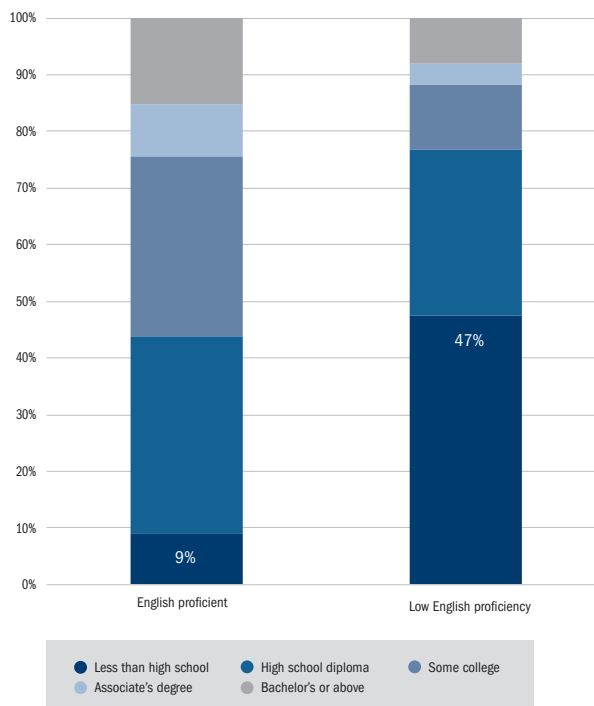
While technology can enhance outreach, it does not solve everything. Other population-specific needs such as age and English proficiency must be considered. For 51- to 64-year-old workers who have a college degree but are trapped in low-wage work, focusing on redeploying existing skills offers a promising approach to upward mobility.¹⁹ Yet these low-wage workers may have the hardest time accessing digital information on how to embark on that journey. More traditional channels, such as newspapers or advertisements at local community hubs, may be most appropriate for this segment.

Attention to language, for another example, may be key to attracting diverse audiences. Of the 11.1 million workers who report speaking English “less than well,” fully two-thirds are low-wage workers. These 7.7 million workers make up 14 percent of the low-wage worker population, meaning that for more than one out of every eight low-wage workers, assistance with reskilling, education, workforce entry, and career navigation could be more effective if provided in a wider variety of languages.

However, these workers are not being “met where they are.” Currently, under 4 percent of low-wage workers with low English proficiency are enrolled in school, compared with nearly 14 percent of English-proficient low-wage workers—meaning that a low-wage worker with low English proficiency is less than one-third as likely to be enrolled in school as his or her English-proficient counterpart. Aside from more diverse language resources and supports, these workers may also need greater outreach in workplaces, rather than schools; access to programs that do not require high school equivalency or support in gaining that credential;

FIGURE 4.2

Nearly half of all low-wage workers with low English proficiency do not have a high school diploma or equivalent



Source: Brookings analysis of American Community Survey data (2012-2016).

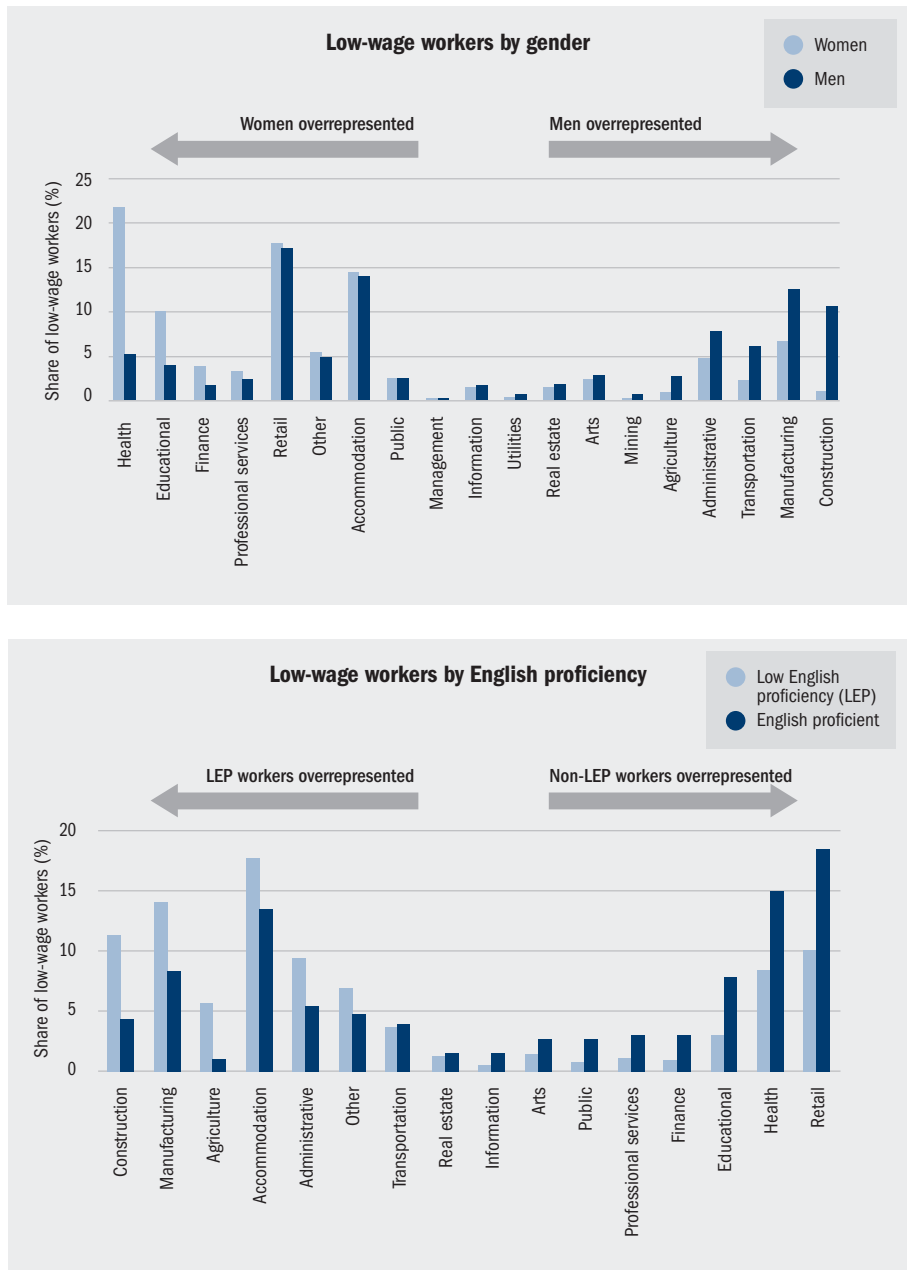
and programs suited to workers farther removed from their last formal education experience.

Nearly 48 percent of all low-wage workers with low English proficiency do not have a high school diploma (figure 4.2) compared with just over 9 percent of low-wage workers who are proficient in English. Educational or training programs that require participants to have completed their secondary education therefore screen out nearly half of all low-wage workers with low English proficiency. Re-evaluating such entry criteria, as well as supporting these workers in gaining their secondary credential, are likely important approaches in making the current reskilling and education space more accessible to low-wage workers.

When seeking to engage low-wage workers of different needs, workforce organizations may find

FIGURE 4.3

Some vulnerable groups tend to cluster in specific industries



Source: Brookings analysis of American Community Survey data (2012-2016).

it useful to focus outreach on certain workplaces and industry sectors as different segments of low-wage workers cluster in distinct sectors.

The extent to which low-wage women are clustered in a small number of industry sectors also indicates both a risk and an asset. More than

half (54 percent) of these low-wage women workers work in just three sectors—retail, health-care, and hospitality (figure 4.3). The healthcare industry employs more than a fifth (22 percent) of all low-wage women workers, compared with just over 5 percent of low-wage male workers. Disruptions affecting even one of these sectors

would leave women workers in a uniquely vulnerable position.

Workforce initiatives targeting women may find attracting low-wage workers into skilling programs to be much more well-defined than for other low-wage workers, who are more widely spread in the labor market. Entry into reskilling may be made much easier for low-wage women workers if the initiatives are in the places where they work—retail, hospitals, educational institutions, and hospitality establishments. Barriers to entry for these workers into skilling programs may also be lowered if marketing, advertisements, and other outreach are matched to the professional functions these workers currently serve.

Low-wage workers with low English proficiency are similarly overrepresented in certain sectors (figure 4.3), including construction, manufacturing, and hospitality. These sectors account for about 44 percent of employment for workers with low English proficiency. There are also differences in diffusion by age across sectors. Young low-wage workers from 18-24 are clustered in the retail and hospitality sectors, where 46 percent of these workers are employed. Efforts to reach this population would be more efficient if focused on these two sectors, but the same would not hold true for prime-age workers (25-54) or older workers (55-64), who are much more diffused in their sectors of employment.

2. Building self-efficacy

“Self-efficacy” is a psychological concept that describes a person’s perception of their capacity to successfully pursue a course of action. It is informed by social and cultural structures, psychological and biological processes, personal experiences, familial beliefs, and a host of other variables.

Prominent psychologist Albert Bandura, who introduced the term, describes it thus: “Among the mechanisms of human agency, none is more central or pervasive than people’s beliefs in their efficacy

to influence events that affect their lives.”²⁰ Most significantly, it is dynamic. Self-efficacy can grow.²¹

Self-efficacy has complex and delicate sources. Harmful stereotypes based on gender, race, and socioeconomic status may compound and negatively impact one’s self-efficacy.²² In addition, positive and negative local environmental factors of family and locality contribute to self-efficacy. It is further influenced by personal traits and behavior and by the interaction between the aforementioned forces.²³

Self-efficacy can be domain specific—along with general self-efficacy, one can possess academic, health, or parental self-efficacy, among other forms.²⁴ While someone may be a highly self-efficacious parent, he or she may feel less self-efficacious in school.²⁵

Why include self-efficacy in the end-to-end reskilling journey?

Self-efficacy is unique among the user journey friction points in that it is a psychological concept rather than a literal course of action. It is perhaps the most important ingredient for success in the reskilling journey. A high degree of self-efficacy must be cultivated early in the reskilling process and sustained for workers to persist and succeed. It is challenging but essential for lifelong learning infrastructure to foster self-efficacy among adults seeking economic mobility.

“I have always been really independent. I always talked to myself about doing more things in the future.” —Isa



Low self-efficacy may be a barrier to both entry and achievement. Isa, being self-efficacious, persisted through her real estate course despite significant barriers along the way. But most low-wage workers tend to have lower levels of

BOX 4.3

Building self-efficacy through course design

CSMlearn is an adaptive learning system that teaches an array of high-performance competencies including numeracy and literacy skills from fourth grade through post-secondary.¹ The platform uses the principle of “core skills mastery;” to progress in the course, learners must master the content by scoring 100 percent, twice in a row.

CSMlearn’s approach is a far departure from the 60 to 70 percent proficiency rate used by most psychometric schemes. It allows learners to feel like “excellent” students, perhaps for the first time in their lives. David Goldberg, founder and CEO, comments, “Ask any adult in America what kind of student they are, and they will be able to tell you: A, B, C, D, etc; people internalize this from a very early age, and unfortunately many people translate this to mean that I am an A, B, C, or D person.” Mastery experiences combat negative self-image by unlocking the joy of producing outstanding work. Over time, they build self-efficacy.²

CSMlearn catalyzes self-efficacy growth with positively affirming nudges. For example, when a learner correctly solves a numeracy problem, CSMlearn prompts them with a message such as, “Only 40 percent of college graduates can complete this problem,” providing a powerful message about students’ own capability.

In a recent SRI International study, CSMlearn was the only adult learning product found to have a

statistically significant impact on raising adult numeracy. While still a startup, CSMlearn is used at dozens of adult learning programs around the country. One encouraging example is the Adult Diploma Program at Cuyahoga Community College, or Tri-C, which primarily serves a high-needs population lacking a high school diploma, comprised mainly of older adults and opportunity youth.

Recent cohorts in the ADP track who score below grade eleven in numeracy and literacy in a pre-assessment have taken CSMlearn as a foundational curriculum requirement toward completion. Students spent a minimum of 12 hours to complete CSMlearn, to a maximum of 566 hours, highlighting the degree of personalization and inculcated self-efficacy and persistence inherent to the design. Upon completing the high school diploma program, 30 percent of students signed up without incentive or prompting for associate degrees and 80 percent have either multi-semester persistence or have completed their degree.³ The 30 percent college-going was surprising, given that opportunity youth and older adult populations of the ADP program go to college in very small numbers, and the 80 percent retention is compared to an overall 50 percent retention in two-year colleges.

CSMlearn demonstrates promising approaches to building self-efficacy for sustained learning success.

observed self-efficacy than the general population,²⁶ due in part to the adverse effects on physical and mental health that contribute to disempowerment.²⁷ Self-efficacy levels are differentiated by socioeconomic status.²⁸ And older Americans display higher anxiety and lower self-efficacy for particular subjects, like math and other STEM fields.^{29,30}

A self-efficacy deficit can spur a damaging negative cycle, while a surplus can do the opposite.³¹ One study reported that, “Students with higher levels of academic self-efficacy demonstrate higher academic goal-setting, value academic

achievement more, spend twice as much time studying, earn higher grades, and report greater concentration and control while completing homework, when compared with students with lower academic self-efficacy.”³²

Insufficient self-efficacy may also prevent workers from entering the reskilling system, pursuing higher education, or attempting a job transition.³³ A 2017 study found that of nearly 13,000 individuals in New York state who earned their GED and indicated intent to enroll in college, only half did so within 12 months.³⁴ This finding replicated an earlier meta-analysis of GED graduates.³⁵ While it

is impossible to causally attribute these outcomes to low self-efficacy, gaps between intention and action suggest the presence of psychological forces that reinforce self-doubt.

Curricula and programs can build self-efficacy

Research points to four building blocks for self-efficacy.³⁶

- Mastery experiences occur when a person successfully “masters” a task, providing authentic evidence of one’s capability.³⁷
- Observational experiences, or vicarious experiences, allow individuals to glean information about their own capability from “peers who offer suitable possibilities for comparison.”³⁸
- Social persuasion by peers, teachers, family members, coaches, and other important people in one’s life provides another informational channel for people to develop their sense of self-efficacy.
- Psychological interventions work to improve mental health and alleviate debilitating stress and anxiety that erode self-efficacy.

“I was proud of myself for taking the test. And I know that once I have more time, I will definitely pass the test, so it is just a matter of time.”
—Isa



Of these sources, mastery experiences most directly affects a person’s self-efficacy.³⁹ Interventions that activate more than one of the building blocks have been shown to be more effective than those that act through a single source.⁴⁰ While many studies highlight the success of interventions that use these building blocks, more

insight is needed about promoting self-efficacy through workforce training design.^{41,42}

3. Navigating careers and systems

The glut of information at one’s fingertips can overwhelm even the most digitally savvy. Where does one even begin the job search, let alone identify training providers that will enable that job transition? And which occupations will leverage one’s skills and knowledge?

Workers face a complex set of choices with little support

Isa had to identify realistic career options that matched her skills, interests, and experience, and presented opportunities where she lived, almost entirely on her own.

While aggregated empirical evidence links more education to higher wages,⁴³ this may not hold true across disaggregated demographics. For low-wage workers, with limited time and money to spend on education, wasting effort on the wrong reskilling path can be devastating. Supporting these workers mandates intentional, systemic effort to move beyond equating education with financial success and instead pair specific educational programming with tangible vocational prospects. There are few experiences more disempowering than the dogged pursuit of education that does not translate into economic opportunity.

Unfortunately, educated workers from diverse backgrounds end up in jobs they dislike or in which they struggle. According to PayScale, nearly half of Americans are underemployed: 46 percent of survey respondents either worked part-time but wanted full-time work, or worked in a job that did not use their experience, credentials, or skills.⁴⁴ Furthermore, a new Gallup poll reports that 60 percent of Americans are in mediocre or bad jobs, and only 48 percent say they are able to change things they are unhappy with about

their jobs.⁴⁵ Proper design of educational and career navigation systems can help rectify these labor-market mismatches.

In addition to pursuing the right new skills, workers must be able to identify and leverage their skillsets to succeed in the job market. The current U.S. career navigation framework privileges formal credentials while failing to validate alternative sources of skills and knowledge. As a result of both formal and informal experiences, workers often possess skills well beyond what their formal credentials might suggest.⁴⁶ Workers who have developed skills through alternative learning pathways need support to understand how they might qualify for opportunities, even if they lack certain degrees or formal titles.

Public infrastructure for workforce development can further confuse and overwhelm workers, especially if they are reeling from job displacement or financial insecurity. With 43 federal education and training programs administered across nine government agencies, simply determining the benefits a worker is eligible for can be a complex task.⁴⁷ Does a disabled veteran turn to the VA or to the nearest American Job Center to learn computer skills? Which of the eight employment and training programs—spanning the departments of Education, Interior, Labor, and Health and Human Services—would best meet the needs of a young, out-of-school Native American worker? In the absence of streamlined government infrastructure, workers need support to navigate a web of helpful, yet daunting, programs.

Career guidance systems are insufficient for lifelong learning

Once in the hands of workers, career navigation can be a powerful tool.⁴⁸ Mathematica Policy Research found that participants who receive help selecting their workforce training outperform those who pursue reskilling without any career coaching.⁴⁹ Another Mathematica report revealed that participants who leverage career

“I always wanted to be a marriage counselor or private investigator, but I couldn’t go back to school for that long.”

—Isa



service workshops and counseling demonstrate better outcomes than those who only have access to basic, self-directed resources.⁵⁰

Despite these clear benefits, today’s skilling infrastructure is insufficient and under-resourced. People make education and career decisions as a result of a complex set of personal, familial, societal, and educational factors. Often, however, their only formal career guidance comes from school guidance counselors who are stressed, overburdened, and charged with supporting students through a host of other academic challenges, mental health concerns, and socio-psychological issues.^{51,52}

While the National Association for College Admission Counseling recommends a ratio of 250 students to one counselor, the actual average ratio in American secondary schools is 464:1, with only three states doing better than the recommended average, with wide variation among the states—Arizona at 924 students per counselor and Vermont at 200 students per counselor.⁵³ This leaves the typical student receiving just 20 minutes of counseling a year.⁵⁴ Due to underinvestment in career guidance, people leave the formal education system unprepared to navigate the increasingly complex world of work.

Reskilling programs provide workers with career guidance that links learning to a clear next step

Adult learners are more motivated by concrete outcomes than children.⁵⁵ Pursuing a concrete goal, like a better job, underpins workers’

BOX 4.4

How Goodwill connects reskilling with job opportunities¹

Goodwill offers a variety of employment programs, from helping businesses fill short-term labor market needs that require quick responses to supporting formerly incarcerated individuals to forge a long-term plan to rebuild their lives. Admirably, many Goodwill organizations serve everyone who walks through their door.

All Goodwill franchisees operate by the same guiding principle—to treat people with dignity and to meet them where they are. “They call me by my name,” a Goodwill service recipient told Wendi Copeland, Goodwill Industries International’s Chief Mission and Partnership Officer.

Goodwill’s ability to accommodate almost anyone relies on having a variety of services to help people with a spectrum of needs.

A central function that Goodwill performs is matching people to services that meet personal needs. Sometimes this means building skills to earn a credential. Other times training leads directly to the labor market. The commonality is that all of Goodwill’s services are directly tied to local demand for talent.

Some people need more intensive services. Goodwill differentiates its services and pairs those in need with a case manager who either directly provides appropriate services or works with community partners who can.

Eighty-two percent of Americans live within 10 miles of a Goodwill. In 2016, Goodwill and its 161-member organizations, operating more than 3,300 stores across America, earned more than \$5.8 billion, 87 percent of it reinvested in employment and other mission-related services. Goodwill served about 2.1 million people through face-to-face programs, and more than 36 million people through virtual services, from online learning programs to virtual coaching support. They estimate that one in every 200 hires in the United States is made with Goodwill’s help.

Despite their reach, even Goodwill mission leaders acknowledge it is hard to know what jobs are in demand in their community. They rely primarily on the purchase of advanced labor market information and relationships with local businesses to gain insight into workforce needs.

engagement in the workforce system and is vital to their ability to persist and succeed. For this reason, it is critical that lifelong learning infrastructure is directly aligned with local employer needs.

A recent MDRC review suggests that technical and vocational educational models lead to higher earnings and enrollment rates in further education.⁵⁶ These models have two notable benefits. First, technical and career-oriented pathways often involve more opportunities for active learning, because the learning is explicitly oriented to workplace activities.⁵⁷ Second, they

align workforce programs with growing industrial needs.

Sector strategies, through which workforce development providers intentionally link programs to labor market demand, can yield high employment placement and wage increases.⁵⁸ This suggests that we need not only to invest more in career counseling and support, but also to provide resources that hone job seekers’ and workforce development practitioners’ ability to identify lucrative and emerging opportunities and leverage workers’ skills to seize them. Chapter 3 suggests some methods to do so.

4. Assisting with economic and social barriers

Even if low-wage workers want to reskill, they must face a host of economic barriers not typically encountered by middle- or high-wage workers.

Isa's real estate licensing course took place on Saturdays and Sundays for 9 hours each day. Given that she worked the rest of the week, this made childcare nearly impossible. Luckily, she had a supportive network that was able to help.

Research suggests that low-wage workers face significant time constraints and additional responsibility

Adult learners are the most time-limited population in post-secondary education. They weigh many factors when considering returning to school: Family and job responsibilities, opportunity cost of attendance, location, direct financial costs, and transportation, are just some. These factors make it more likely for adult learners to attend school part-time and live off campus, which isolates them from the larger campus community.⁵⁹

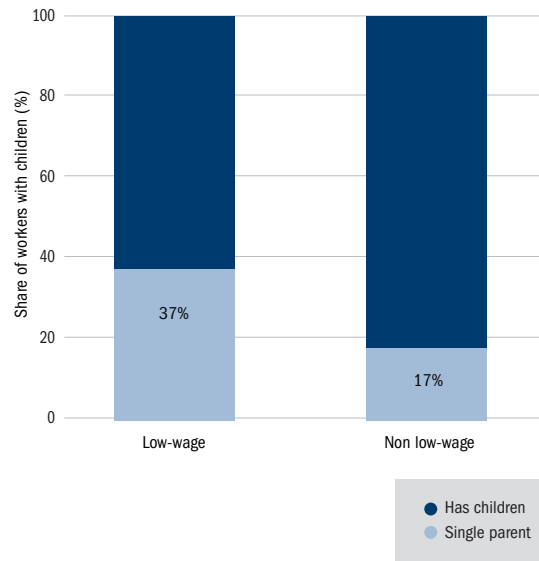
Research indicates that nontraditional students with two or more "risk factors," such as part-time enrollment or financial independence, complete bachelors' degrees at a rate of only 17 percent, compared with 54 percent among traditional students.⁶⁰ Non-traditional students have unique needs that are often not considered specifically in program design. Instead, they are largely treated as an extension of services geared toward the traditional population.⁶¹

"My mom took care of my kids most of the time, or my kids were with their dad. Sometimes I had to hire a sitter." —Isa



FIGURE 4.4

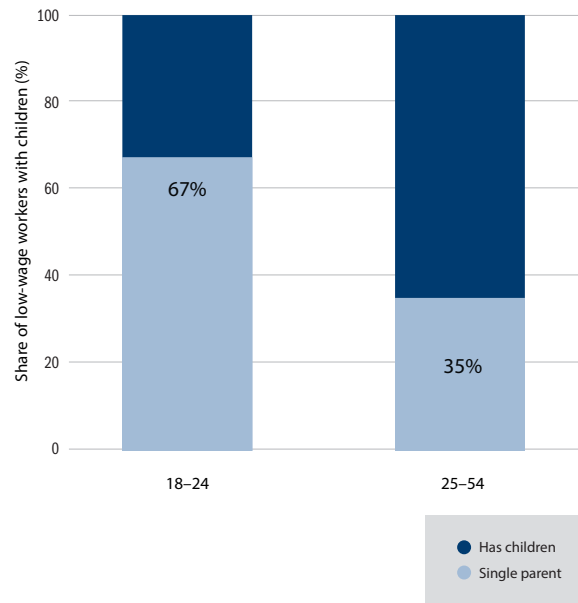
Single parenthood among workers



Source: Brookings analysis of American Community Survey data (2012-2016).

FIGURE 4.5

Single parenthood among low-wage workers



Note: Workers with children manage extra responsibility and face extra financial constraints when reskilling. Low-wage workers are disproportionately likely to face these challenges as a single parent. The barrier is even more salient among those low-wage workers between ages 18-24.

Source: Brookings analysis of American Community Survey data (2012-2016).

BOX 4.5

The importance of coaching

Coaching can help job seekers across a number of friction points. From career and system navigation to dealing with social and economic barriers and persisting through school, coaching fosters student success. A recent randomized controlled trial measuring the efficacy of coaching for more than 13,000 majority non-traditional college students found that students assigned to a coach were more likely to persist and be enrolled in university one year after the coaching ended.¹

Colorado and Indiana are experimenting with novel ways to increase the impact of career coaches. Through a partnership with the Markle Foundation, Colorado formed the Skillful Governor's Coaching Corps. This program identifies outstanding career coaches from across sectors and enhances their impact through an intensive skill-building program that focuses on leveraging new technologies and highlights best practices from the field. Each cohort meets with state-level policymakers to provide recommendations for how policies can be designed to improve state-wide workforce outcomes.²

Low-wage workers are more likely to be single parents and work full-time, year-round

Low-wage workers face several challenges that may inhibit their success in the reskilling ecosystem. Twenty-nine percent of low-wage workers have children. Thirty-seven percent of low-wage workers with children are single parents, compared with 17 percent of non-low-wage workers with children (figure 4.4). Younger low-wage workers are most likely to be single parents. 67 percent of those that have children are single parents, compared to 35 percent of those age 25-54 (figure 4.5). To dedicate time to reskilling, these individuals often need childcare support.

In addition, more than half of low-wage workers work full-time, year-round, and 74 percent of low-wage workers work year-round either full or

part-time. Financial constraints compound time constraints. By definition, low-wage workers earn less per hour. Their median annual income is just \$17,950, compared with \$54,410 for non-low-wage workers.

Among low-wage workers, 44 percent (23.7 million) live below 200 percent of the federal poverty line, and 16 percent (8.6 million) live below 100 percent.

As a result, these cohorts may find it particularly difficult to marshal the time and financial resources necessary to reskill.

Wrap-around services can support workers to make reskilling possible

The term “wrap-around services” refers to the types of comprehensive support services that people need to mitigate these additional barriers. Programs that provide intensive, intentional wrap-around services demonstrate success. For example, the Accelerated Study in Associate Programs (ASAP) run by the City University of New York (CUNY) provides intensive wrap-around services for adult learners. The program “includes mandatory advisor meetings; tutoring for struggling students; a College Success Seminar that teaches good study habits, time management, and other soft-skills; career advising and job placement services; tuition waivers for students not fully covered by financial aid; and free Metro cards and textbooks.”⁶² This strategy helped almost 55 percent of its students graduate within three years, nearly triple the rate at a traditional two-year institution.

Project QUEST in San Antonio provides another successful example. In a randomized controlled trial that measured outcomes over six years, graduates of Project QUEST earned \$5,080 more than the control group, and 94 percent of entrants to the program graduated within six years. This program successfully delivered results among traditionally underserved populations;

90 percent of participants were female, and 75 percent were Hispanic. The program includes seven wrap-around components to help students through their journey, including a case manager to assist with funding applications, referrals to social services agencies, and subsidies for transportation and childcare.⁶³

“The math in the class was hard, and you had to pay extra for extra help.”
 –Isa



5. Providing good content and good teaching

If quality learning depended solely on decent content, people in the education and workforce worlds could pack their bags and go home. With Google, Wikipedia, and more recently the rise of MOOCs and other distance learning offerings, high-quality, accurate content seemingly exists to address just about any question.

through K-12 can be successfully applied in the adult learning context. Still, adult learners have specific needs that must be woven into lifelong learning infrastructure design.⁶⁴

Here are four hallmarks of good teaching pedagogy and design for adults in the workforce system.⁶⁵

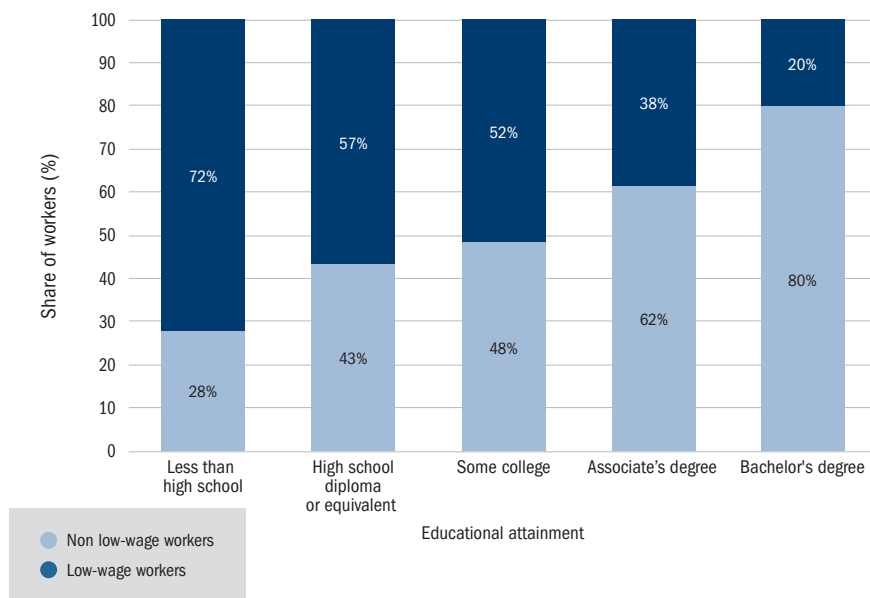
Content should be designed to meet students where they are and provide multiple pathways to success

But much more is needed to help people turn raw information into usable knowledge. Academic literature on good teaching, while extensive, focuses primarily on children and adolescents in the K-12 system. Even so, many of the best practices

Isa hadn’t done serious math since high school. When she needed extra help with the math in her

FIGURE 4.6

Educational attainment of non-low-wage and low-wage US workers



Source: Brookings analysis of American Community Survey data (2012-2016).

BOX 4.6

Arizona State University Earned Admission

Arizona State University's charter reads that it will be measured as an institution, "not by whom it excludes, but by whom it includes and how they succeed."¹

In seeking to fulfill this mission, ASU enacted a policy of not formally rejecting any student on academic grounds. Instead, academically ineligible students are routed to a new "Earned Admission" program, providing a pathway to a university degree.

Earned Admission gives anyone interested in pursuing a university education the opportunity to demonstrate their potential to succeed. Students must complete their courses with a minimum grade point average (GPA) of 2.75. The number of courses required for a student depends on factors such as age and prior educational attainment. Students only pay for the courses if they are interested in pursuing credit at ASU, and are not required to do so until after they have completed the course and can

calculate their overall GPA. This significantly lowers barriers to entry for students who are unsure that they are interested in and capable of earning a university degree. More than 400 students have earned admission to ASU since the program launched.²

To scaffold the student journey further, ASU Earned Admission utilizes an adaptive math program for its college algebra course. The course designs content and material according to learner needs assessed through diagnostic exams, even if that requires building math skills significantly below college level.

Earned Admission courses represent the next iteration of ASU's Global Freshman Academy, launched in 2015, as an experiment to reduce barriers to pursuing a college degree through MOOCs providing university credit. Global Freshman Academy was the first university program to experiment with giving credit for MOOCs, now a common offering across institutions.³

real estate licensing course, the learning company offered her a remedial math lesson—for \$100.

It is essential for students to encounter learning content that closely matches their skills. M. David Merrill, in his *First Principles of Good Instruction*, writes, "It has long been a tenet of education to start where the child is. It is therefore surprising that many instructional products jump immediately into the new material without laying a sufficient foundation for the students."⁶⁶

The process for educators to adjust content to students' current knowledge and comprehension level, or slightly above it, is known as "scaffolding." More experimental evidence is needed to determine whether, why, and how content scaffolding supports adult learners. Even so, the notion of scaffolding resonates with practitioners and builds off Lev Vygotsky's zone of proximal development theory, which posits that learning takes place when students are pushed to integrate new

ideas and material that are just beyond their current ability. This notion can inform the content (knowledge), process (teaching strategy), and products (student outputs).⁶⁷

Strategies like scaffolding are especially important to consider in light of the numeracy and literacy skills of many adult learners. According to the Program for the International Assessment of Adult Competencies (PIAAC), 45 percent of American adults lack minimally sufficient literacy or numeracy skills to succeed as an adult. According to analysis by the Organization for Economic Co-operation and Development (OECD), one in six adults in the United States has low literacy skills, and one in three has low numeracy skills.⁶⁸ When disaggregated along racial lines, 35 percent of Black and 43 percent of Hispanic adults have low literacy skills, compared with 10 percent of whites. These racial gaps persist for numeracy, with 59 percent of Blacks and 56 percent of Hispanic adults scoring below proficiency, compared to 19 percent of whites.

Recent research on MOOCs points to a mismatch between content level and student ability. A recent analysis of 65 courses on Coursera and edX found that while 80 percent of them did not list prerequisite knowledge or experience—including descriptions such as “No background is required; all are welcome!”—they actually possessed significant academic and skill requirements.⁶⁹

This is not a new problem in higher education. Developmental and remedial education have been used as a way to “deal” with unprepared adult learners, though the evidence on their effectiveness is mixed and limited.⁷⁰ And while practitioners and researchers have advocated active contextualized pedagogical techniques since the 1990s, recent evidence suggests that much developmental and remedial education focuses on discrete decontextualized skills.⁷¹

Further study should examine the content offered by workforce programs, and specifically whether the content requires a knowledge or skill foundation beyond the reasonable expectation of what most non-college degreed adults may have. The scant research that does exist confirms a mismatch between content offered and the needs of a typical adult seeking to upskill.

The dialogue around developmental and remedial education must shift from a deficit-based mindset to a growth mindset. Based on PIAAC data and OECD analysis, a significant proportion of adults in the United States need development and remedial education.⁷² Why employ stigma-laden language like “developmental” and “remedial,” when learner “deficits” are typically the result of weak educational and workforce advancement systems, rather than their own shortcomings?

Once we accept the need for scaffolded adult learning, we must decide which educational systems are responsible for which outcomes. In theory, everyone should leave high school with these skills. In practice, this is not the case. For reskilling to provide a meaningful pathway to social

mobility for low-wage workers, lifelong learning infrastructure must be designed in a way that acknowledges and responds to these questions.

In a perfect world, learners who need to start at a fourth-grade literacy level or a high school math or science literacy level would encounter material suited to their needs. While this is a difficult standard to meet, scaffolded curricular design shows promise; students should encounter differentiated learning materials as they progress through the reskilling user journey, across skill domains such as math, reading, and writing. Short of this, education and workforce programs can at least provide on-ramps to educational pathways that will help learners succeed.

Active learning techniques should be incorporated into educational experiences

Making learning more “active” by providing learners the opportunities to engage with the content through hands-on practical tasks is a bedrock principle of good teaching.⁷³ It centers around students and their learning, rather than the instructors and their teaching.⁷⁴

Active learning is especially important for adults. Unlike children, who may view educational content as a prerequisite for secondary and tertiary learning, adults engage in learning to improve their lives in a much more immediate sense. So, it is critical that content connects directly to their lives.⁷⁵

“Nine hours of straight talking. I would have preferred at least six hours of notes and then three hours of activities or group work. It was really hard for me to study after, and I would fall asleep while trying to.” —Isa



Active learning has been found to improve student outcomes in the classroom, especially in STEM.^{76,77} Dramatic gains in university-level physics courses have been reported as a result of implementing a more active learning approach.⁷⁸

Early evidence suggests that more interactive learning also yields better outcomes in the realm of digital education. It is difficult to disentangle the selection effect—are better students more likely to engage, or did the engagement help the learners progress? That said, a number of recent experiments suggest that better integrating active learning opportunities may yield better student outcomes. For example, evidence from a study of MOOCs suggests that participating in discussion forums is a strong predictor of student engagement and completion. While the overall number of students who engage in the discussion forum is small (15 percent), these students are twice as likely to complete the course.⁷⁹

Different methods promote more active learning, including problem-centered learning, cooperative learning, peer-to-peer instruction, inquiry and discovery-based learning, and even simple “think-pair-share” exercises. These student-centered strategies prompt learners to reflect on new ideas and figure out how to apply them in real-world contexts.⁸⁰

It is not enough to provide students the opportunity to participate in class; providers can promote more engagement in learning activities outside the classroom as well. Email nudges, for example, may be effective. A recent study found that sending emails highlighting popular forum discussions and unanswered questions increased forum activity. Reminder emails about unseen lecture videos also increased lecture views.⁸¹

Active learning strategies could have helped Isa. Her real estate course consisted of nine hours of lectures on Saturdays and Sundays. She mentioned that she would have appreciated the opportunity to work with others and engage

in some activities to make the learning relevant and stimulating. She also wanted to practice the knowledge she was supposed to be acquiring.

Effective strategies for active learners like Isa can range from implementing large, hands-on activities to providing small nudges, across physical and digital environments. The key is to meaningfully engage students in the material they are learning.

Interventions should be psychologically affirming

One common psychological barrier is a “social identity threat,” the self-doubt arising from negative stereotypes associated with a given group identity.⁸² Women, members of minority racial and ethnic groups, and people with low educational attainment experience social identity threat most acutely. Experiences of social, academic, and professional disempowerment internalize a narrative of self-doubt and self-consciousness that inhibits performance and feeds a self-reinforcing negative cycle.

Social identity threat can impede economic mobility—the prospect of going back to school or applying to a better job can stimulate feelings of inadequacy and a lack of worthiness that may make the process seem futile. These concerns are more acute in adult learners, who hold “an extensive depth of experience, which serves as a critical component in the foundation of their self-identity.”⁸³ Educators must be sensitive to the fact that adult learners have much more developed identities that may not be self-affirming or optimistic.

Brief, values-affirming interventions have improved outcomes for students facing social identity threat. These interventions are often “small” and target student beliefs, feelings, and thoughts in and about school. They do not teach content. Instead, they shape students’ perceptions of themselves and their relationships to school. These interventions have a strong track record of

BOX 4.7

Merit America

Merit America is a non-profit organization that provides educational pathways to high-skill careers for adults without bachelor's degrees. Its programs pride themselves on being fast, flexible, and aligned to what employers need most.¹ Merit America partners with top employers to understand their specific skill requirements, secure priority hiring commitments for graduates, and co-locate in regions where vacant jobs exist. The programs require 20 hours of coursework a week for 13-22 weeks and include an IT support track and a Java developer track.

To make the program more accessible, Merit America provides small stipends to offset costs associated with the program such as transportation and additional childcare. Interested students demonstrate commitment and potential by completing a rigorous onboarding process that involves 5-6 stages of assessment activities.

Students are paired with coaches for biweekly individual meetings, optimized to fit the student's schedule. Students also have a small group "squad," comprising five to eight students and a coach, which meets weekly at a set time to promote consistency, mutual support, and accountability. Content is delivered through a blended learning model, where students engage with online resources, and then have their learning reinforced through their coach, squad, community events, and tech-enabled supports like email and text message nudges.

While Merit America launched only in 2018, more than 170 of their students in Washington, D.C. and Dallas have graduated from their program with industry-recognized credentials, and on average experienced a \$15,000 wage increase in their new career.

replication and show effects on student achievement outcomes.

For example, one study examined the effect of a values affirmation exercise in which treatment group students wrote about a core personal value, while control group students wrote about a more psychologically neutral theme. The affirmation exercise improved the grade point average (GPA) of Hispanic students and also shifted the way they responded to subsequent stressors, as well as their sense of "self-integrity, self-esteem, hope, and higher academic belonging."⁸⁴ Other studies corroborate that value-affirming interventions can improve GPA and close the achievement gap for African-American students.^{85,86} One intervention narrowed the achievement gap for first generation college students in a biology course by 50 percent and increased retention in a key entry course required for advanced study by 20 percent.⁸⁷

These sorts of interventions pose real potential for successful scaling, as they have been

implemented in online course environments and shown to improve outcomes of students from less-developed countries who may experience social identity threat in westernized learning environments.⁸⁸

Flexibility in program structure can help adult learners succeed

We have established that adult learners are especially likely to face time, financial, and familial constraints when returning to school. They often elect to enroll in part-time or online programs that provide more flexibility.⁸⁹

Flexibility can come in many forms. Part-time, online, hybrid, and practicum-based courses all represent models that can afford adult learners rich learning opportunities that complement and accommodate their work experience. The ideal balance of online versus offline remains to be discovered. While a 2010 U.S. Department of Education report found parity in student outcomes between online and on-campus student outcomes,

BOX 4.8

Toward Employment

Toward Employment, a workforce development program in Cleveland, runs a variety of programs for job seekers across a large spectrum of need including those who were formerly incarcerated, young adults disconnected from school or work, and low-wage workers struggling to advance.¹ TE works with participants to develop long-term career plans comprising incremental shorter term personal, educational, and employment goals.

The core feature of the program is career coaching. Coaches are instrumental in implementing a four-step model that emphasizes continuing to advance along a career pathway. Step one prepares people for work with “soft skills,” and helps them develop job search and financial literacy skills. In step two, TE connects participants with the technical training and resources to secure a job based on employers’ needs and the job seeker’s skills. Step three focuses on the practical skills to keep a job, returning to work, day in and day out. In step four, TE extends the model beyond entry-level employment—it sticks with participants and help them advance on their career pathway by developing technical and leadership skills.

Using this model, TE connected 612 Cleveland residents to better jobs last year. Remarkably, it provided follow up services to 100 percent of its clients.

TE accomplishes this by implementing strict protocol for coaches and creating the expectation with participants throughout the program that they will communicate regularly with their career coach, even after they are placed in a job. Coaches are expected to stay in touch with job seekers during their first week on the job, every other week for the first 90 days, and then monthly or bimonthly based on need for the following year. Active communication with participants is tied to coaches’ performance goals and is monitored closely.

Chelsea Mills, a director of business services, explains that the sustained support is “equal parts art and science.”

“It’s about creating expectations with participants from day one, developing the buy-in that we’re on a career pathway together, building relationships, understanding each person’s motivators, and developing short- and long-term goals that form the basis of the Personal Career Map. From there, providing ongoing career coaching is a natural extension of the professional relationship. We make every attempt to update the Personal Career Map quarterly. And in addition to the one-to-one support from the coach, participants remain eligible for our full array of services. This can include support services, legal services, and skill building through technical training or work experience.”

other researchers have challenged those conclusions, particularly among the most vulnerable students, for whom online environments lead to worse outcomes.^{90,91}

Certainly, not all online or part-time education programs are created equally. Indeed, the decline of for-profit education in the past decade reflects the weak labor market value of some of these programs.⁹² That said, many non-profit digitally enhanced offerings show real promise, especially among marginal groups. Southern

New Hampshire University, Western Governors University, and Arizona State University are some of the leaders in this space. And creative models like that of the Open University in the United Kingdom have served underrepresented working professionals for decades. While online models and flexible learning methods may not yet be perfect, they meet proven workforce needs. Their lower costs and lack of logistical barriers can be key for students who have no other option than to balance learning with myriad other responsibilities.

6. Sustaining support

Isa failed her real estate license exam. Her class did not adequately prepare her and left her with little to show for it. For many people, the loss of time, energy, resources, and attention devoted to childcare and to other life needs would have dealt a devastating blow. Yet Isa's grit and optimism in the face of adversity and her belief in her ability to pass the exam later is inspiring. Remarkably, Isa persisted despite the absence of support structures in her workplace, school, or community that would proactively seek to engage her in lifelong learning.

Successfully reskilling and landing a better job is, in many ways, just the start of a worker's journey. To break cycles of poverty and economic stagnation, low-wage workers must continue to succeed by securing promotions and continuing to develop new skills, attitudes, and knowledge. But few workers receive sustained support throughout their workforce development journey. Only 43 percent of a sample of 332 programs serving low-income, unemployed persons across the nation provided post-employment support to the majority of participants beyond basic monitoring.⁹³

The significance of sustained support is relatively underexplored in research literature. While many workforce development programs stimulate an initial income bump, long-term outcomes are more tenuous. For example, a recent comprehensive study of federal jobs programs found four years after the intervention that only 37 percent of workers remained employed in the field in which they were trained.⁹⁴ Another study estimates that after 10 years, returns to worker retraining fully erode.⁹⁵

Much more research and experimentation are needed to understand the best ways to provide sustained support services, with clear outcomes and measurement in mind. America's rapidly shifting economic landscape requires continual worker engagement with lifelong learning, along with infrastructure and support mechanisms that rise with workers and facilitate long-term upward mobility.

Strengthening economic resiliency demands a multipronged effort involving educators, employers, policymakers, and learners. Much more focused effort can distill the best methods to support workers adapting to a rapidly digitizing economy in ways that will ensure lasting benefits rather than transient improvements.

Recommendations

1. Direct local economic development towards industries that accelerate growth but also bring good jobs. Our feasibility and strategic indices (found in our previous report) present a map that can inform those choices.¹
 2. Use occupational composition by industry at the city level to understand the occupations likely to grow or decline and translate this understanding to estimate gaps in the local workforce.
 3. Leverage job-to-job transition data to maximize the road to upward mobility for workers- with a specific focus on low-wage workers. These data can inform investments in reskilling, both inside companies and through workforce development efforts.
 4. Consider the workers' reskilling journey. The nation needs massive investment in reskilling- inside and outside companies. For that infrastructure to benefit those being left behind, a user design focus is crucial. That means encouraging workers to enter the system, building self-efficacy, helping them navigate career choices, assisting with economic and social barriers, providing good content and teaching, and sustaining support throughout the reskilling journey and beyond.
 5. Work with companies, which are the linchpins in affecting low-wage work, to create good jobs with benefits and mobility. This involves discouraging operational practices that seek efficiency at the cost of job quality, such as the de facto creation of a two-tier system of contractors and full-time employees. For firms, this means collaborating with policy leaders to come up with incentives and regulations to even the playing field so that all companies, not just 'enlightened ones,' invest in reskilling and track progress.
 6. Build capabilities—especially talent—in order to compete for and retain industries, rather than offering tax incentives.
- These strategies can foster a virtuous cycle toward inclusive growth.

APPENDIX

Methods

1. CPS job transitions methods

The data

We use Integrated Public Use Microdata Series (IPUMS) of the Current Population Survey (CPS) to construct a dataset of job-to-job transitions. We choose the CPS over other sources of job change data for its high resolution in terms of monthly observations and for its fidelity representing the population.¹ We match individuals who are surveyed in consecutive months using person-level identifiers (CPSIDP), designed to facilitate reliable matching and longitudinal analysis.²

Of 4.8 million mechanical matches, a small set are improper as evidenced by a mismatch in age, gender, or race. Another small set of observations also have occupation or industry information imputed in the case of non-responses or refusals. The imputation methods are designed to retain demographic representativeness but lead to spurious occupation/industry transitions in month-to-month matching. A final set of observations are seemingly improperly coded as “not in the universe” of respondents who should be asked whether their employer is the same as it was in the previous month and likely also have industry and occupation information imputed.³ We drop all of these observations and then, since the drops are correlated with demographic information, reweight the observed sample using inverse probability weighting to reobtain a representative sample.⁴

Finally, we aggregate observations of month-to-month labor market behavior from 2003-2019 to yield a matrix of observations of individuals’ transitions between industries and between occupations. We use SOCXX codes that aggregate some detailed SOC codes in order to be comparable

over time. We have integrated these SOCXX codes into the transitions data. From these data we obtain the likelihood that an individual who changes occupations will transition into any occupation, given their initial industry. With some differences, our general approach aggregating job transitions is largely informed by the work of Isha Shah and Chad Shearer.⁵

Occupation (near-term) mobility index

One of the initial difficulties in thinking about the value of transitions across the wage scale is that most transitions from the lower end are upwards, while those from the upper end are downwards. We did not consider this to be a valuable finding, as a model in which individuals transition randomly would show the same pattern. We decided to characterize each occupation by the degree to which it diverged from a model in which starting median wage is the only predictor of ending median wage.

We first created a simple model for all individual transitions in the dataset as a function of initial wage. We included a log of the initial wage to help account for some of the non-linearity.

$$\begin{aligned} (\text{Final Wage} - \text{Initial Wage}) = \\ \beta_0 + \beta_1 \text{Initial Wage} + \beta_3 \log(\text{Initial Wage}) + \epsilon \end{aligned}$$

For each individual transition in the dataset we thus have a predicted value and a residual that shows the deviation from that predicted value. Grouping the residuals by occupation, we can get an estimate of whether a particular occupation tends to produce higher or lower transitions than its median wage level would predict.

We consider this index to be a preliminary calculation. We would like to characterize the null model

as a random walk in which the expected value of a transition is constrained to probable actual transition steps: that is, individuals can only make transitions to nearby occupations as defined by empirical description of the actual labor market. The creation of that model is beyond the scope of this report but will follow in the next stages of this project.

Individual mobility index

To calculate whether an individual transition was above or below the expected value, we followed a similar process. In this case we simply took the difference between initial wage and final wage for every transition from each occupation. We characterized this as a distribution with a mean wage difference for the transitions from each occupation along with a standard deviation for that distribution. This allows us to state whether any particular transition is substantially higher or lower than what one might expect from individuals in that occupation. The occupation mobility index allows us to compare transition values across differing occupations, while the individual mobility index allows us to compare individuals within a particular occupation.

In future work, as we compare this wage-based conception to the actual transitions in particular locations, industries, and occupations we expect to find useful insights into where to focus resources on reskilling and industrial policy. We also plan to include models of skills-based transition probabilities as another point of comparison.

2. Summary of Emsi + BLS projections methodology

The goal of this work is to generate localized estimates of employment in an occupation in a place in 2028, in a way that can be brought together with other work on industry complexity, low-wage workers, and occupation transitions.

We do this by applying BLS projections for national occupation-industry employment and industry employment growth between 2018-2028 to Emsi local staffing patterns for 2018. In order to make all datasets reconcile, they need to operate on the same set of NAICS and SOC codes. We use 4-digit NAICS codes as these are the codes used in *Growing Cities that Work for All*.

Transforming the BLS matrix

The raw BLS matrix contains estimated US employment in every industry-occupation pair where employment is present, for 2018-2028. It includes NAICS codes and SOC codes at a range of levels, not all of which match perfectly with the NAICS and SOC codes used in the Emsi staffing pattern matrices.

In the BLS Full Matrix Projections file we overwrite certain NAICS and SOC codes to match with their Emsi counterparts. We then extract three key items:

- An industry-occupation matrix, which draws out the sum of employment in 2018-2028 for every industry-occupation pair that matches our unified set of NAICS and SOC codes at the three-digit level.
- An industry matrix, which sums employment in 2018-2028 across all these industry-occupation pairs for every industry in our set of NAICS codes.
- An occupation matrix, which sums employment in 2018-2028 across all these industry-occupation pairs for every occupation in our set of SOC codes.

From these matrices we extract a US industry-occupation multiplier, which is the nationally projected change in employment from 2018 to 2028 for a particular industry-occupation pair. We also extract a US industry multiplier, which is the

nationally projected change in employment from 2018 to 2028 for a particular industry.

Transforming the Emsi matrices

The raw Emsi staffing pattern for a particular city contains estimated employment in every occupation pair for detailed NAICS and SOC codes for 2018. We overwrite these detailed codes with their equivalent code from our unified set of NAICS and SOC codes.

We then collapse the matrix to this level, such that it contains estimated employment in a place in 2018 for every industry-occupation pair in our unified set of codes. We drop employment in religious and military organizations and unclassified industries or occupations, as these are not projected by BLS or used in any of the rest of our analyses.

Calculating within-industry employment change

To calculate the change in occupational employment within an industry in a city, we first apply the US industry-occupation multiplier to the local 2018 employment level for each industry-occupation pair. In some cases, Emsi identifies employment in an industry-occupation pair for which there is no BLS projection. These are held constant (a multiplier of 1).

This process not only alters the total employment in a particular pair, but also the overall size of an industry in a place. In order to have only the within-industry change, these numbers need to be deflated such that the total industry size in a city remains at its 2018 level. Deflators for each industry in each city are calculated and applied to all of the industry-occupation pairs within that industry in that city. This results in a final 'within-industry estimate'.

One consequence of this process is that any industry-occupation pairs held constant in the

previous step are also deflated. However, these are generally small numbers given they are so insignificant as to be overlooked by BLS.

Calculating 2028 employment based on our industry-city projections and BLS industry projections

To calculate 2028 employment, we apply the forecasted industry growth rate detailed at the city level with our model to the within-industry estimated employment in each industry-occupation pair for each city. Lastly, that projection is then adjusted such that the aggregate growth rate across all cities within an industry is equal to the national industry growth rate projected by BLS.

This results in an estimate of employment in each industry-occupation pair in each city for 2028 that accounts for both within-industry changes in occupation and nationally projected industry growth.

To calculate city-level occupational change, we then aggregate total employment across all industries in each occupation in each city in 2018 (directly from Emsi) and 2028 (from our projections), to observe the changes in occupational employment at the city level and their difference from national occupation growth.

Estimating the additional number of workers by occupation to develop an industry of interest

Having the forecasted employment by industry and occupation for each city to 2028, it is possible to provide an estimate of the number of workers by occupation needed to staff a given set of target industries in each city in 2028.

To provide an estimate of that number, we first calculate the number of workers needed to turn each of the otherwise-nascent industries to 2028 into competitive ones, such that the industry's

share of employment at the city and national level matches, or, in other words, that its Revealed Comparative Advantage reaches 1. This approach is only feasible if we isolate each case and consider the additional number of workers needed by each industry in each city as exogenous, with no implication on other industries' employment within or outside the city.

We then decompose that number of additional workers by industry by the projected share of workers by occupation in the corresponding city-industry pair and end up with an estimation of additional workers needed at the city, industry, and occupation level.

We know of no similar, publicly available methods to project industrial or occupational employment at the city level. Therefore, to test the model against a benchmark, we compare our forecasts with those made by the BLS at a national level, forced down to the city level. We find our model outperforms this "naive model" in terms of accounting for variation between city-industry-level growth and with a smaller root mean square error.

3. Examining the determinants of variation in city-level share of low-wage workers

Growing Cities that Work for All found that cities with higher economic complexity indices (ECI) tend to have higher median incomes. That finding was robust when controlling for a variety of potentially confounding variables. On the face of it, this might imply that cities with higher ECI would also have lower shares of low-wage workers. Instead, we found a positive correlation between cities' level of industrial complexity and higher shares of low-wage workers (table 1). We think the most plausible explanation for this finding is that the presence of complex economic activity generates demand for labor, and disproportionately for low-skill labor. To better assess this hypothesis, we explore the association between economic complexity and the employment share of those with lower educational attainment in the 100 most populous cities (table 2), data we obtain from the Brookings Metro Monitor. We find that the presence of complex industries tends to associate with higher employment rates for low-skilled workers. Complex activities seem prevalent in places where people without a high school degree are able to find jobs, many of which still earn below the local low-wage thresholds.

TABLE 1

	(1)	(2)	(3)	(4)	(5)	(6)
	Share of LWW	Share of LWW	Share of LWW	Median income	Median income	Median income
(Intercept)	0.45 *** (0.00)	0.59 *** (0.01)	1.11 *** (0.31)	29,367.02 *** (207.95)	18,681.63 *** (1,178.67)	36,700.94 (26,881.7)
Economic complexity index	0.01 * (0.00)	0.00 (0.00)	0.01 (0.00)	1,358.71 *** (274.29)	1,508.78 *** (245.78)	1,112.96 ** (354.41)
Share of population employed		-0.42 *** (0.04)	0.02 (0.05)		31,230.18 *** (3,350.87)	-8,310.86 (4463.39)
Additional controls	None	None	Demographics + Education + Industry structure	None	None	Demographics + Education + Industry structure
<i>N</i>	373	373	373	373	373	373
<i>R</i> ²	0.017	0.318	0.762	0.091	0.315	0.754

Note: All continuous predictors are mean-centered and scaled by 1 standard deviation. Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

TABLE 2

	(1)	(2)	(3)
	(%) Employed (less than high school)	(%) Employed (less than high school)	(%) Employed (less than high school)
(Intercept)	0.51 *** (0.01)	0.45 *** (0.06)	2.08 * (0.84)
Economic complexity index	0.02 *** (0.00)	0.03 *** (0.01)	0.04 * (0.02)
Average firm size		0.00 (0.00)	
Net domestic migration		0.00 (0.00)	
Controls of industry structure	No	No	Yes
<i>N</i>	100	100	100
<i>R</i> ²	0.18	0.21	0.48

Note: All continuous predictors are mean-centered and scaled by 1 standard deviation. Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

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Chapter 2

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Chapter 4

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Box 4.2

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Box 4.3

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Box 4.4

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Box 4.5

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Box 4.6

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Box 4.7

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Box 4.8

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Recommendations

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