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Tools for Regional Competitiveness to Meet an Era of Labor Scarcity

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[1]The opinions expressed in this document are solely those of the author and not necessarily those of any institution or funder of the author's past or current work. This report is informed by work of the author as part of the National Network for Critical Technology Assessment, as an affiliate and research collaborator at the Block Center for Technology and Society, and by extensive qualitative interviews conducted by the author and collaborators with a regional and national set of workforce development professionals as part of work with the Allegheny County Department of Human Services. To preserve the confidentiality of these discussions, specific organizational titles are not used when discussing examples (but insights are indicated where appropriate as originating from these discussions generally).

Introduction

At a time of historic tightness in U.S. labor markets, regional leaders face opportunities to improve prosperity for local populations, especially in regions with historic underinvestment and lower workforce participation. Simultaneously, unmet labor demand can hinder the productive adoption of new technology or scaling of economic development opportunities. While national labor demand is high and often going unmet, as evidenced by historic vacancy rates (St. Louis Fed 2023), there are important regional differences in the content and magnitude of skill demand, which must inform workforce strategy. Skill demand shocks to regional labor markets can be driven by differential rates of technology adoption and innovation (Andre and Zheng 2018), changes in exposure to global trade (Autor, Dorn and Hanson 2016), and large-scale public (e.g. federal subsidies for onshore battery production) or private investment (e.g. Intel's new greenfield fab in Columbus, Ohio) in production capacity. These shocks can vary across regions and may differ significantly from national trends, producing a divergent or "K-shaped" economic recovery[2] and long-run outcomes for workers under different conditions (Buffington et al 2021; Dalton et al 2021).

This report places regional economic development within the national labor market context. It offers perspectives on lenses and empirical resources for evaluating regional capabilities and needs, as well as levers and analytical barriers for regional decisionmakers in meeting workforce demand challenges, with attention to the comparative advantages (and differential needs) of their populations.

Labor Market Context

We live at a moment of apparent contrast in employment trends: amidst labor market tightness and rising wages, we see historically low (though recovering) rates of labor market participation (U.S BLS 2023). A greater share of job-switchers now realize real wage gains (and that the gains are larger) than before Covid (Pew 2022).[3] Job vacancy rates are down from March 2022 but still 40% higher in January 2023 than at any point in the years 2000-2019 (St Louis Fed 2023), and thus offer workers extensive opportunities to switch positions to realize wage gains. Yet the rate of voluntary job separations is only 10% greater than at its previous height shortly before the beginning of the Covid pandemic (BLS 2023). This divergence (illustrated in the

[2] The "K-shape" implies a divergence in economic outcomes over time (e.g. since Covid-19) for different economic groups such as large versus small firms or low versus high income earners. For example, see Dalton et al (2021).

[3] The Pew survey asks respondents about outcomes from their job-switching, including their wage before and after the switch. The apparent gain in wages is identified by comparing results from historic and recent surveys. Datasets such as the U.S. Current Population Survey and Annual Social and Economic Supplement can also be used to identify administratively how *occupational* transitions have changed (occupations here are a superset of jobs: a person might change jobs but remain an industrial technician and thus keep their occupation).

following figure) suggests that some gains from occupational mobility may be going unrealized and that barriers to job transition (or labor market entry) may be weighing down supply responses to unmet labor demand. These barriers may be related to acquiring the necessary skills to bridge gaps between incumbent occupations and vacant positions (Dejong and Ingram 2001), or to costs and uncertainty related to the job search itself, which are potentially more constraining for lower-income workers (Phillips 2014).

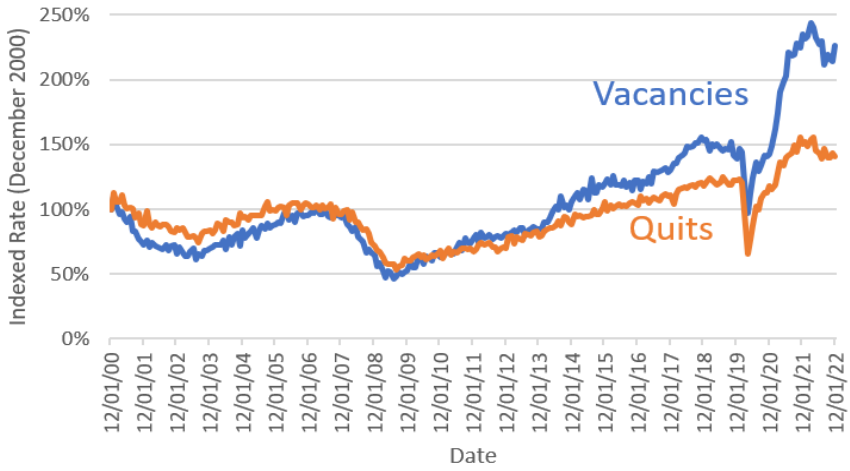

Figure 1: Indexed Vacancy and Quit Rates December 2000 - December 2022 (St. Louis Fed, 2023)

Currently, demand in the U.S. labor market is high across skill levels (Aeppli and Wilmers 2022), potentially indicating a shift in labor demand away from the "hollowing out" of middle skill demand observed in prior decades (Autor and Dorn 2013).[4] Whereas historic wage and employment patterns have trended away in both absolute and relative terms from occupations historically at the "middle" of the distribution in the labor market, current labor market phenomena suggest *growing* demand for workers at the bottom and middle of the income distribution. This demand pattern presents both an opportunity for occupational "laddering" and a challenge for filling needed middle and high skill roles because of higher wages for jobs with lower training requirements.

These national trends are not of uniform magnitude across regions or industries. For instance, in U.S. manufacturing, the shortage of technology- and process-specific skills is so significant that the U.S. Chamber of Commerce estimates that labor demand exceeds *total* current skilled labor supply by 35% (U.S. Chamber of Commerce 2023). Industry and regional demand

[4] Autor and Dorn use wage-based measures to show that the distribution of demand for those occupations that were at the middle of the income distribution in the last quarter of the 20th century saw a significant decline in relative employment demand compared with occupations at the top and bottom of the historic wage distribution. The conclusion is that a "polarization" of labor demand has occurred: insofar as wages are treated as a proxy for worker skills in what is called the Skill-biased Technology Change literature, this polarization is attributed to a technological bias toward substituting for workers in tasks that typically require "middle" skills (specifically a bias from automation toward "routine" tasks that can be codified for a machine).

differences overlay onto patterns of significant outmigration from the largest (and most expensive) US regional labor markets (Whitaker 2021). At the same time, significant new attention is paid to regional economic development in the priority-setting and spending allocation of large-scale public investment supported by programs such as the Build Back Better agenda and the Chips and Science and Inflation Reduction Acts. Private investment has also grown significantly in large capacity expansions for U.S. manufacturing (often following or complementing public spending), particularly in industries such as semiconductors and electric vehicles where skill needs are rapidly evolving and potentially very different from supply in target investment regions.

Meeting skill demand requirements requires regional as well as national strategy. Despite enhanced flexibility from remote and hybrid work for many, the share of job postings that offer remote work is declining, down to 13.2% of January 2023 LinkedIn job postings from 20.6% in March 2022 (WSJ 2023). While 56% of employees believe that their jobs could be performed remotely, only 11.2% of the workforce is expected to work fully remotely over the long-term (Gallup 2022). The large majority of labor demand and workers are thus expected to be served by regional labor markets into the future, with the attendant geographic frictions (see, e.g., Choudhury 2022).

The Origins of Skill Demand and Why They Matter

Meeting skill demand in regional markets, especially in the case of skills that take a long time to develop (e.g. through a 2- or 4-year degree), requires an understanding of what drives the demand for different skills (and how those drives may change with time). While human capital is not the only reason that firms choose to conduct business in one region or another, it is both a resource in demand and a motivation for firm decisions such as technology adoption. Skill demand is not exogenously determined, but rather a choice. Firms may set their demand for worker skills in response to a variety of factors, including:

- The availability and cost of different levels and types of skill[5] both in the labor market and in competing markets
- Adoption of technology that substitutes for workers with a given level or type of skill
- Adoption of technology that increases the productivity of workers with different skills
- Complementarity or substitutability of different workers based on their skills

The Covid-19 pandemic has accelerated investment in and adoption of many digital technologies that promise to alter the demand for skill and potentially reduce important frictions in labor markets (e.g. remote work). However, these are not the only technological trends at play in industries with high workforce demand. Regional differences in accessible labor supply will persist, especially for lower- and middle-income workers and workers in

[5] Hence, increasing the supply of a given skill may lead dynamically to firms increasing their demand for that skill in the future (see for example Cunah, Carahan and Soares 2011).

sectors such as manufacturing in which production tasks are perhaps more tightly coupled to geography than (for instance) some digital service industries (Sevinc et al 2020).

Not all technological change is equal in its implications for skill demand, and indeed different technologies acting simultaneously in an industry might have opposing effects: for instance, past work in manufacturing shows at the level of individual process steps that while automation can have a polarizing effect on the demand for worker skills, consolidation of parts into a monolithic design can lead to a convergence of demand toward middle skills (Combemale, Whitefoot, Ales and Fuchs 2021). The characteristics of technology adopters and processes in which they are adopted are also relevant for skill demand outcomes: for instance when production tasks are made easier to divide through technological innovations that support modularity of products (Baldwin and Clark 2008) or services (Brax et al 2017), firms may choose to divide and specialize production and in turn demand skills that are more polarized (Ales, Combemale, Fuchs and Whitefoot 2023).

These choice mechanisms provide levers for anticipating possible needs to support forward looking workforce development policy, and supporting technology choices that match the comparative advantage of a regional labor market, such as a relative abundance of one set of skills (e.g. equipment management for manufacturing) over another (e.g. financial service skills) (for further discussion of regional comparative advantage see Sukkoo 1999).

Much of the current economic literature on technology change is focused on unidimensional measures,[6] such as education, or proxies such as income (Ingram and Neuman 2006; Hakanson, Lindquist and Vlachos 2021). This limitation plays out especially with respect to the deployment of responsive training programs and other workforce development interventions, which require multidimensional skill measures (see Van Laar et al 2020; Combemale et al 2021) to know *what* skills to provide (and need a systematic way to identify region-specific technology-industry mix).

Gaining Situational Awareness of Evolving Skill Demand

In order to understand the demand for skill and developing approaches to meet that demand, it is first necessary to have a common taxonomy for describing skills and other forms of human capital, so that demand and supply can be compared and specific, actionable gaps identified for resolution through workforce development. The O*NET taxonomy developed by the U.S. BLS serves this function, describing skills, abilities and knowledge requirements (and their level of importance) for different occupations characterized within the Standard Occupational Classification (SOC) system. These requirements are elicited through surveys of workers

[6] Unidimensional measures use a single channel to capture features of interest, which means that they can mask important variations and opportunities. For instance, using level of education alone as a measure of skill inhibits analysis of how different *types* of education may be important for different innovation-enabling functions.

employed in each occupation: the results themselves are publicly available on the O*NET online database, but the survey instruments are useful as tools for characterizing worker requirements more precisely, such as for specific job titles or production activities rather than broad occupations (e.g. Combemale et al 2021). Though designed for use with public administrative data, the SOC code framework is also used for interoperability with private data sources, such as online job postings captured by business intelligence companies such as Lightcast.

It can be difficult (and costly) for regional leaders to anticipate industry needs from new technology adoption and to support corresponding workforce development. Federal data collection instruments such as the AI Adoption supplement to the Annual Survey of Businesses can provide insight into the distribution of technology adoption behavior (Acemoglu et al 2022), which combined with insights from the literature on skill demand can inform workforce development strategy. Such approaches are likely to rely heavily on aggregated data that may not take into account regional specificities in adoption behavior. Regional leaders can improve their awareness of the skill demand requirements of technology adoption, especially when adoption is supported by public investment, by preconditioning funding support on a workforce-oriented perspective on impact assessment. Such an approach would measure outcomes through reporting requirements and developing anticipatory mechanisms by requiring innovators and technology adopters, such as small businesses applying for support, to provide systematic evaluations of how the technological solutions they develop may require new or different skills or may change business operations in ways that might be predicted to change the distribution of skill demand.

In particular, federal funding to support innovation and workforce development, such as through the American Rescue Plan, Chips and Science Act and Inflation Reduction Act is allocated in significant part through existing regional entities, such as local workforce boards in the case of workforce development funds governed by WIOA, or through collaborative networks of government, academic, entrepreneurial and other entities that originate funding proposals for federal grants. Regional decision makers thus have significant potential leverage in how they establish grant requirements for distribution of funds.

Technologies are rarely adopted in isolation, and so the mix of technology choices by firms is significant for identifying skill mix and anticipating how (and which) emerging technologies might change demand in the future. The technological content of different industries (in terms of which technologies are used, to what extent and in what combinations) is also relevant for the skill needs of different regional workforces: for example, industries with a higher level of automation may place higher demand on software skills to code commands into equipment, while demanding fewer dexterity or other physicals skills. The types of skills demanded may differ, but also the distribution of skills: for example industries that adopt integrated production technologies may converge their demand toward a common set of “mid-level” skills rather than highly differentiated bundles of skills (see Combemale et al 2021).

In turn, regions may have different incumbent industries to serve or a particular comparative advantage to meet the skill needs of new entrants into their local labor markets. These differences in industry and workforce composition drive the comparative advantage of regional labor forces. Indeed, what may be more significant for regional labor markets and economic competitiveness is not the skills demanded by frontier technologies, meaning those that are new or still-changing, but the skills necessary to adopt and fully exploit mature technology which has been longer-established and may be more diffused throughout the economy.

Technology deployment is uneven across regions, industries and firms, and there are potentially significant gains for productivity to be had from solutions interior to the technology possibility space, the set of technologies that are available to meet different industry and regional needs. When choosing from a set of technologies in which to invest directly and for which to make complementary workforce development investments, regional economic competitiveness may be best served by the "low hanging fruit" of established rather than new or rapidly changing technologies. By way of example, continuous processing solutions and other longstanding manufacturing practices remain exceptional rather than standard in critical US industries such as generic drugs manufacturing (Hock, Siang and Wah 2021), where thin profit margins, small firm sizes, and lack of ready human capital hinder adoption of production standards and processes that currently benefit brand-name drug manufacturing. While advanced solutions on the leading edge for non-generics manufacturing could be productive in generics, it may be more economical and more feasible from an incumbent workforce skill perspective to support manufacturers in overcoming the barriers to adopting well-established operations practices and realizing predictable gains.

Meeting Skill Demand

Regional leaders have several levers to enhance labor-market match, whether as part of a gradual development strategy or in response to significant demand-side shocks such as a large outside investment. These include skill-specific or industry-specific training programs, such as those offered by traditional 2- and 4-year college institutions as well as apprenticeships and targeted training courses. Training ecosystems are often fragmented (e.g. Stuart and Carpenter 2015), without full national or even local awareness of the domain of available training (or the quality of training provided). This fragmentary arrangement can result in missed opportunities to connect workers to trainers to employers, as well as driven intense diseconomies from scale, such as high administrative overhead for many different organizations all interacting with common sources of funding (e.g. Department of Labor support). Regional leaders can thus play an important coordinating role between existing sources of demand and supply: within the regional workforce ecosystems, workforce boards solicit skill needs from employers, but more systematic efforts and funding structures may be needed, such as industry consortia and administrative streamlining, to meet labor demand at scale from large investments. Coordination can also include reducing informational asymmetries through convening power

around funding sources, to improve mutual awareness of participants in the workforce development ecosystem.

Developing effective regional workforce development policy also requires situational awareness of populations that may benefit the most from workforce development opportunities, be most likely to pursue such opportunities, have specific barriers to participation (e.g. transportation or opportunity cost from working wages) that can be overcome through policy interventions (Sussman 2002), or that are specifically eligible for outside resources that can support regional workforce development efforts. Building and maintain in-house analytical capabilities is costly, and collaboration with outside institutions such as universities can be an important source of intellectual capita to carry out much-needed assessments of the effectiveness of different programs and tracking of workforce outcomes. Likewise, being able to identify individuals that are eligible for specific funding opportunities is critical to making the most of resources such as federal WIOA funding, which often have specific qualification criteria that pose a challenge for effective recruitment. Partnership between funders, institutions with individual administrative data to pre-evaluate eligibility (e.g. human services agencies or labor departments) and community-facing institutions with direct access to candidates once identified (e.g. human services, philanthropic organizations), can identify unserved individuals and increase participation in workforce development programs. For example, the Allegheny County Department of Human Services is helping to connect workforce training providers and funders to eligible trainees through an administrative data identification strategy.

Yet, data-sharing frictions can impair effective institutional collaboration. Barriers to information transfer within these vital pipelines accentuate the effect of the fragmentation of the workforce development ecosystem by requiring smaller organizations to rely on internal capabilities in order to conduct analysis. Moreover such frictions can threaten identification and matching of eligible individuals to opportunities, as well as undermine outcomes evaluation and hence improvement of workforce development policy.

Another important consideration in meeting skill demand is the robustness of the labor market, and the transferability of skills. Training can meet the requirements of an immediate job, but regional decisionmakers with a long-term perspective can support investment targeted at skills that are cross-cutting across occupations (to reduce the risk of obsolescence), complementary with emerging technologies. Labor market robustness in this context means that a set of skills is demanded in multiple industries, to improve the absorptive capacity of labor markets if one firm or industry should fail and thus reduce the economic disruption to workers.

Conclusion

Regional leaders interested in workforce development face three significant trends that require strategic and long-term responses:

- The dramatic increase in public spending to support onshore development of labor-intensive industries such as battery manufacturing, while labor vacancies remain high (and hence potentially outsize economic rewards for regions meeting labor demand).
- Labor demand that is more widely spread across worker skill levels than in past decades and hence potentially more readily met by regions with lower levels of past workforce education or other skill formation.
- Potentially significant variation in skill demand over time in the future, such as from emerging technologies (Rios 2020) or differences in demand between industry capacity-building and long-term utilization of capacity.

To realize the economic potential of historic levels of public and private investment and engage competitively in an economic period bound by labor constraints, regional decisionmakers must position their local workforces to respond to current and emerging skill demands, while encouraging technological investments that are well-matched to the current or buildable capabilities of workers. Without a workforce able to effectively meet the demands of changing technology and new investments in industrial capacity, regional economies risk losing out on private and public investment itself or on the potential returns to investments that are made.

In turn, regional leaders need systematic approaches for identifying skill demand and supply and recovering applicable mechanisms to resolve mismatches. Skill supply can be thought of both in terms of workers who currently satisfy a set of skill requirements (and who are willing to accept employment within a given firm or industry at given wages and nonpecuniary benefits), and in terms of those workers who have the potential to gain a set of skills. Understanding the supply chain of skills from this perspective is a major research focus of my ongoing work with colleagues Krishnan and Telang at the Block Center for Technology and Society and my collaborators within the National Network for Critical Technology Assessment: future work in this vein will seek to develop analytical tools to assist firms and policymakers in identifying demand and potential sources of supply and assisting these decisionmakers as well as workers themselves in estimating the return on different forms of workforce investment (including cost to individual trainees), to support better allocation of resources toward resolving this critical economic constraint while improving economic and career mobility for workers.

With significant interest and spending towards manufacturing reshoring, capacity expansion is stymied and facilities have at times failed entirely due to shortages of skilled labor (US Chamber of Commerce 2023). Such costly outcomes may be especially harmful to smaller and less robust regional labor markets. Because large-scale investments are often all-or-nothing, with many potential candidate regions competing for a single position (see for example the inter-city competition for the location of Amazon's second headquarters (Collinson 2020)), it may not be feasible for each region to prepare the necessary training infrastructure to meet the demand shock. Enhancing labor-market robustness is not simply a matter of winning one or more high-profile funding opportunities. It will require creating conditions to meet the demand of many (perhaps smaller) firms that enter the region or that are created locally, and to support career

ladders that enable workers to respond flexibly to shifts in the profile of labor demand over time.

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