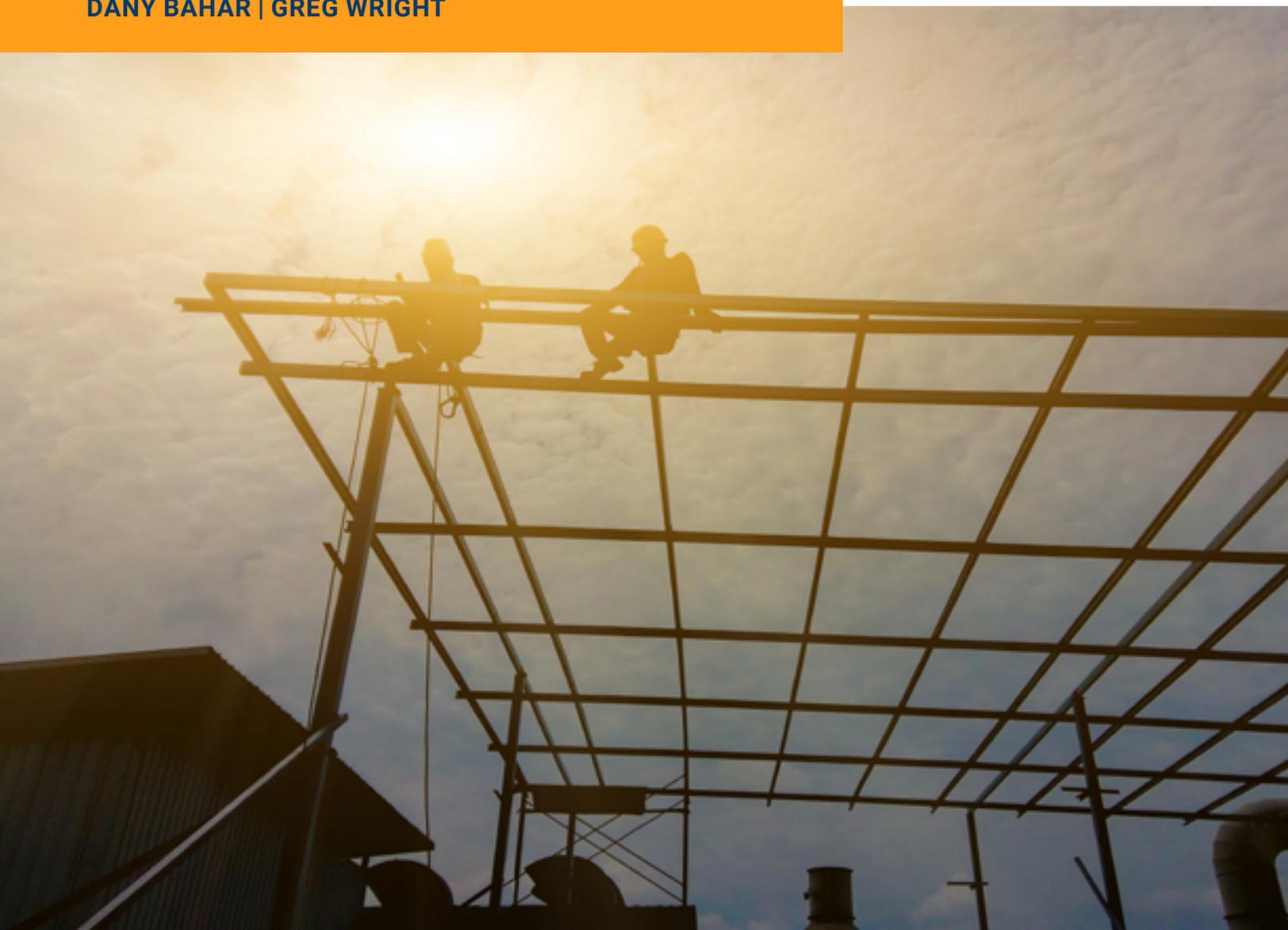


A ROADMAP FOR IMMIGRATION REFORM

IDENTIFYING WEAK LINKS IN THE LABOR SUPPLY CHAIN

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Executive Summary

The last time the U.S. enacted major immigration reform was the Immigration Reform and Control Act in 1986. Since then, little has been done to fix what has become a broken system despite heated debate at the national, state, and local levels.

Unfortunately, the immigration debate has also become increasingly disconnected from the exigencies of the U.S. economy, even in the aftermath of the COVID-19 pandemic in which worker shortages and labor market dysfunction have become increasingly glaring. Worse still, the aging U.S. workforce and structural shifts toward a more service-oriented economy will likely deepen much of this dysfunction unless policymakers can agree to major reforms to shore up the U.S. workforce.

This report aims to support these necessary reforms by highlighting the areas of the economy that are most in need of workers. Importantly, our approach not only highlights occupations that are—and will continue to be—in greatest demand, but also the occupations that are most complementary to the existing workforce, ensuring that efforts to meet these labor market needs will support all workers. At the core is a framework that we call the Occupational Opportunity Network, which identifies strategic occupations that will be in high demand for the next decade; are historically immigrant intensive; and have a high degree of complementarity with other occupations. In short, we define highly complementary occupations as those that are central to the U.S. workforce in the sense that they are used as inputs to many different industries and, within those industries, tend to augment the employment of other workers.

This framework can support immigration reform efforts in Congress and the executive branch—for instance, when considering the scale of any expansion in the number of H1B (specialty, high education) and H2 (temporary services) visa categories or in devising new policies, possibly including some of those that we discuss at the end of the report.

We show that the H2B visa program should be expanded to accommodate increased hiring of hospitality workers, drivers, construction workers, and care workers. Similarly, the H1B visa program should be expanded to accommodate increased hiring of health care workers, executives, and engineers, among others.

It is important to note at the outset that the jobs that we identify as high-value needs for the economy are not intended to be used as explicit targets for policy. Immigration system reforms will necessarily need to be broad-based, and we assume that the market will allocate workers most efficiently, an assumption that is bolstered by research showing that immigrants are highly efficient equilibrators of labor markets. This report is instead meant to outline the nature and scale of the workforce problems that the U.S. currently faces and to highlight the effects that different types of reforms will likely have in alleviating the wide-ranging labor market dysfunction that exists.

We begin by describing the current U.S. labor market context, noting the important distortions caused by the pandemic and their relationship to the immigrant workforce. Next, we present our detailed framework, the Occupational Opportunity Network. Finally, we offer some practical policy applications.

The post-COVID U.S. labor market

Over the past year, the number of new job openings in the U.S. grew by nearly half a million, while the number of filled openings fell by nearly 200,000.¹ This continues a trend of historically tight labor markets that has persisted for over two years and shows no sign of abating. This labor shortage has been driven in part by strong demand for goods and services as Americans continue to spend down pandemic-era savings. But the supply side has also played an important role. For instance, many people have still not returned to work and labor force participation remains a full percentage point below its pre-pandemic level. In addition, the drastic decline in immigration during the pandemic reduced the stock of foreign-born workers by nearly two million compared to what it would have been in the absence of the pandemic. And this decline has not been confined to high-immigration states on the coasts—many of the hardest-hit labor markets are fast-growing, midsized cities in the Midwest.

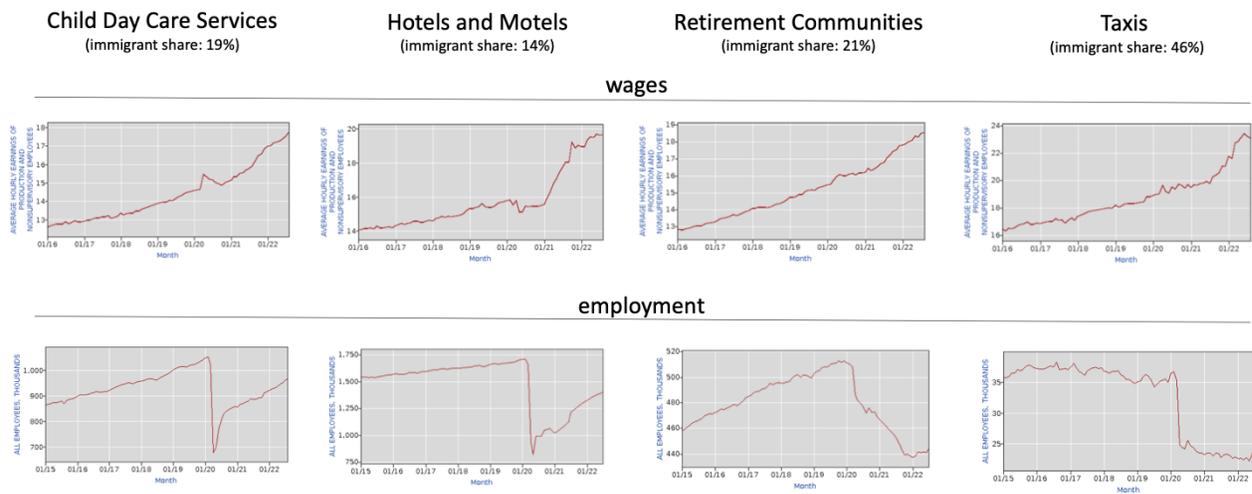
As we discuss below, this labor shortage may be a harbinger of things to come, as the aging U.S. population and falling birth rates more permanently reduce the supply of workers. In this report, we show that the consequences of the labor shortage for U.S. workers may be even larger than it appears, as immigrant workers tend to work in occupations that are particularly central to the economy and particularly complementary to other occupations.

Confronting labor market tightness in the short run

It is important to note that many U.S. workers have exploited the current labor market tightness to upgrade to better jobs. Often these new jobs require specialized training or skills that these workers would not otherwise have acquired, which has been a boon for millions of workers who will carry this know-how with them through their careers. But this shift has also left a sizable hole in the labor market for less specialized, more routine work that employers have been struggling to fill. In fact, the shortage of workers in these jobs has persisted despite substantial wage growth in low-paid work, with wages rising faster than prices for most of these workers.

¹ Bureau of Labor Statistics, “Job Openings Levels and Rates by Industry and Region, Seasonally Adjusted - 2022 M06 Results,” accessed August 27, 2022, <https://www.bls.gov/news.release/jolts.t01.htm>.

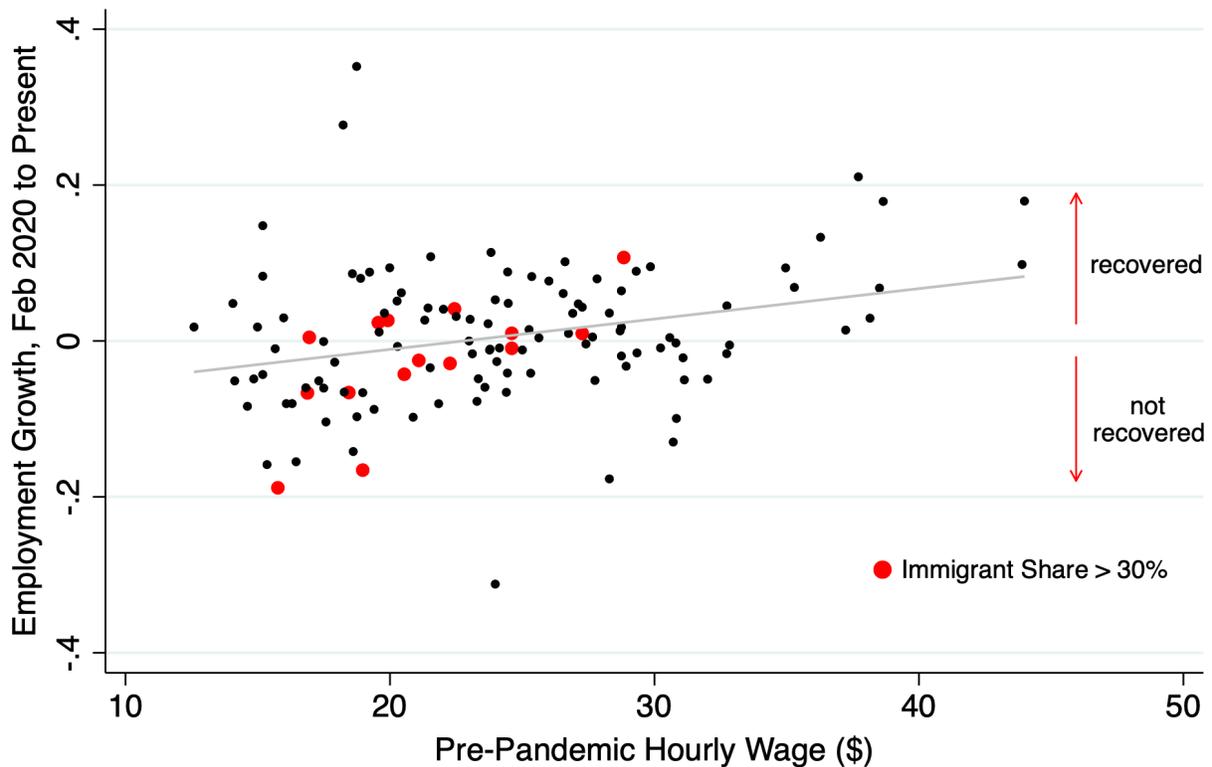
Figure 1. Some industries are still far from recovery (2016 to present)



Data source: Bureau of Labor Statistics

Figure 1 documents these facts for four representative industries over the past four years, though there are many other industries whose experience has been similar. Each of these industries has been experiencing strong wage growth, but weak or non-existent employment growth and, consequently, is falling far short of meeting demand for its output. The core problem facing firms in these industries is that they simply pay too little for what is often arduous work. In some cases, firms in these industries are unable to raise wages due to an inability to pass increases in costs through to prices. This is the case, for instance, in the child care sector which serves especially price-sensitive customers and is therefore constrained to pay low wages. These firms are often competing for workers with firms in industries like freight trucking (\$27/hour) or warehouse and storage (\$23/hour) that employ similarly educated workers but pay higher wages and, in many cases, offer superior working conditions.

Figure 2. Pandemic recovery and wages by industry



Data source: Bureau of Labor Statistics

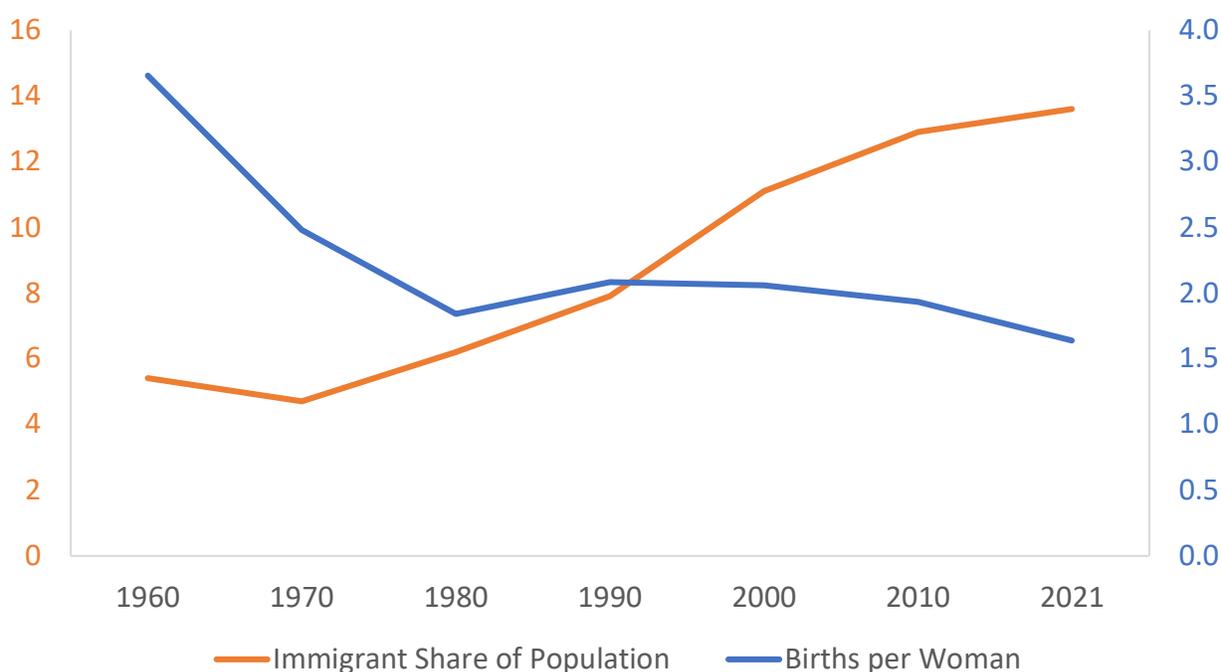
Figure 2 documents these facts with a more systematic approach, plotting employment growth from February 2020 to the present against the pre-pandemic hourly wage of non-supervisory workers for all U.S. industries. The figure, therefore, measures the extent of industry recovery from the pandemic as a function of its wage and highlights the fact that the industries that remain furthest from recovery tend to be the lowest-paid jobs. For instance, essential services like health care and child care, which were too scarce and costly before the pandemic, have seen drastic declines in availability that have persisted for many months. Figure 2 also shows that many of these struggling industries are historically highly immigrant-intensive.

A sign of labor markets to come

Finally and perhaps most worryingly, the current labor shortage may simply be the canary in the coal mine, warning us about the consequences of a coming population and workforce decline. Since the Great Recession in 2008, the birth rate in the U.S. has been falling, recently reaching a historic low. If this trend continues, the only way to offset this decline and maintain overall population growth will be through greater immigrant inflows. In fact, this is exactly what

happened following the dramatic decline in the fertility rate during the 1960s—as Figure 3 shows steep drop in fertility coincided with a steep rise in the immigrant share of the population and, consequently, the U.S. population continued to grow in subsequent decades. But the slowing growth in the immigrant population evident in Figure 3—driven in large part by the pandemic along with Trump-era immigration policies—is now coinciding with an accelerated decline in the fertility rate as well. This is a recipe for a continuation of the labor market dysfunction that currently plagues the U.S. economy.

Figure 3. Immigrant population change and births per women over time



Data source: U.S. Census data

Taken together, these facts highlight the need for comprehensive immigration reforms accompanied by greater workplace protections for low-wage workers. This report focuses on the former while setting aside discussion of broader workplace reforms and protections such as those that have been proposed to improve working conditions for care workers, manufacturing workers, and hospitality workers. Next, we focus on identifying the highest-value occupations that these types of immigration reforms should target.

The Occupational Opportunity Network: A roadmap for immigration reform

This section presents our main tool to analyze the role of immigrants in the U.S. labor market and to help policymakers modernize the current immigration system.

We create and present a tool to visualize and identify occupations that have the following characteristics:

- Are highly complementary to other occupations in the economy.
- Will experience high levels of labor demand over the next decade.
- Have been traditionally filled by immigrants.
- Require little or no prior specialized training.

Our analysis is performed for a list of 89 occupations as defined by the Standard Occupation Classification (SOC). In what follows we briefly discuss the key measures used in our analysis.

Complementarity between occupations

We begin by describing our primary metric which is designed to allow policymakers to identify occupations that are central to the functioning of the U.S. economy because they complement many other occupations. This can serve as a starting point for understanding where targeted immigration policy can make the biggest difference in alleviating both short- and long-run labor supply shortages while raising overall U.S. productivity.

Workers are complementary to one another to the extent that they bring different skills to the workplace that raise the productivity of the workers around them. In academic literature, complementarity has been explored between workers with different combinations of experience and education. Peri (2016) provides a discussion of the trade-offs associated with estimating complementarity with different groupings of workers.²

² Giovanni Peri, "Immigrants, Productivity, and Labor Markets," *Journal of Economic Perspectives* 30, no. 4 (November 1, 2016): 3–30, <https://doi.org/10.1257/jep.30.4.3>.

Here we take a somewhat more flexible approach by focusing on occupations as the relevant grouping of workers. In this context, complementarity between two occupations can be defined as a negative “cross-price elasticity.” For instance, consider two occupations, occupation A and occupation B. Suppose that we observe that the wage in occupation A goes up and, as a result, demand for labor in occupation A goes down. And suppose that in response to this same wage change, the demand for workers in occupation B also goes down. Since the demand for workers in occupation B went in the opposite direction to the wage change in occupation A, we can say that the occupations have a negative cross-price elasticity and are therefore complementary.

In practice, we characterize two occupations as being complementary if their employment shares move in the same direction within industries over time, which is a stronger notion of complementarity than just looking at levels of employment.³ On the other hand, a weakness in this measure is that the co-movement in employment shares will often arise because the occupations experience some common external shocks—for instance, they may be located in the same regions of the country or the same industries, and those regions or industries may be doing well or poorly. Nevertheless, even this “endogenous” co-movement of occupation shares provides information about the strength of the relationship between occupations, even if driven by forces external to the way they are used in the production process.

To construct this measure, we use Lightcast Staffing Patterns Data to first calculate the change in the share of employment in each occupation within industries over the period 2009 to 2019. Next, for each occupation, we calculate the pairwise correlation between changes in its employment share and the employment shares of all other occupations. As an example, we find that the complementarity between “food and beverage serving workers” and “cooks and food preparation workers” is 0.49. This number indicates that in at least 49 percent of industries when either of the two occupations was both present and one of them grew (or shrank) as a share of total employment the other one also grew (or shrank). We can also visualize the pattern of correlations in a network diagram, which we present below.

We then create an overall “complementarity index”—ranging from 0 to 1—for each occupation by taking the average of all its pairwise complementarity values. Importantly, we calculate the pairwise correlations for each industry separately; as a result, occupations that appear in a wider range of industries are more likely to be present with other occupations and be assigned non-zero

³ It is stronger because when the share of employment in one occupation rises the share in all others mechanically fall. So for two occupation shares to move in the same direction this mechanical effect must be overcome, implying that the two occupations are especially complementary.

correlations, mechanically boosting their complementarity index. Therefore, occupations that serve as inputs across many parts of the economy will be deemed to be more complementary, which is a margin of impact that we believe adds value to the measure. Appendix A explains the calculation in more detail.

Table 1. Top 10 occupations with the highest overall complementarity

Code	Name	Employment 2019	Overall Complementarity
37-3000	Grounds Maintenance Workers	962,670	0.254
43-9000	Other Office and Administrative Support Workers	3,541,850	0.253
33-9000	Other Protective Service Workers	1,495,880	0.253
13-2000	Financial Specialists	2,755,470	0.253
27-3000	Media and Communication Workers	591,650	0.251
35-3000	Food and Beverage Serving Workers	6,135,730	0.251
43-1000	Supervisors of Office and Administrative Support Workers	1,427,260	0.251
49-1000	Supervisors of Installation, Maintenance, and Repair Workers	475,000	0.250
41-9000	Other Sales and Related Workers	628,640	0.247
51-1000	Supervisors of Production Workers	599,900	0.247

Note: This table presents the 10 occupations with the highest overall complementarity according to our calculations. The first column, the Standard Occupation Classification (SOC), is the code used in the data for each occupation. Column 2 is the name of the occupation. Column 3 presents total employment in the U.S. for that occupation for 2019, while Column 4 presents the overall complementarity.

Source: Report authors

Table 1 presents the 10 occupations with the highest overall complementarity. The most complementary occupation is “grounds maintenance workers,” with an overall complementarity of 0.25. This is an example of how tasks requiring little formal education can be highly complementary to other tasks in the economy. At the same time, the list also includes high-education occupations such as financial specialists and media and communication workers that are strongly correlated with employment in their respective industries and are also used in many different types of industries. We also note that the measure is unrelated to the size of the workforce in each occupation.

Labor demand

We proxy demand for occupations both nationally and at the Metropolitan Statistical Area (MSA) using employment projections from the U.S. Bureau of

Labor Statistics (BLS). Figure 4 presents the fastest-growing occupations according to these projections. We see that some of the fastest growing occupations are in health care support, personal care and service, and food preparation- and serving-related occupations (though some of this growth is clearly due to recovery from the pandemic). Similarly, computer and mathematical occupations are expected to see fast employment growth as part of the strong demand for IT services in the context of growing telework.

Figure 4. Top 10 fastest-growing occupations, BLS projections 2020-2030

	Percent change, projected 2020-30	Employment change, projected 2020-30 (in thousands)	Median annual wages, May 2021
Wind turbine service technicians	68.2%	4.7	\$56,260
Nurse practitioners	52.2%	114.9	\$120,680
Solar photovoltaic installers	52.1%	6.1	\$47,670
Statisticians	35.4%	14.9	\$95,570
Physical therapist assistants	35.4%	33.2	\$61,180
Information security analysts	33.3%	47.1	\$102,600
Home health and personal care aides	32.6%	1,129.9	\$29,430
Medical and health services managers	32.5%	139.6	\$101,340
Data scientists and mathematical science occupations, all other	31.4%	19.8	\$100,480
Physician assistants	31.0%	40.1	\$121,530

Notes: This figure visualizes the projected percentage and nominal employment change of occupations in the U.S. over the period 2020 to 2030, as well as the median annual wage for those occupations in 2020. Data excludes occupations that had a decline in wage and salary employment greater than the decline for all occupations from 2019-2020 (approximately 6 percent). This list excludes growth due to pandemic recovery.

Source: Occupational Employment and Wage Statistics program, U.S. Bureau of Labor Statistics.

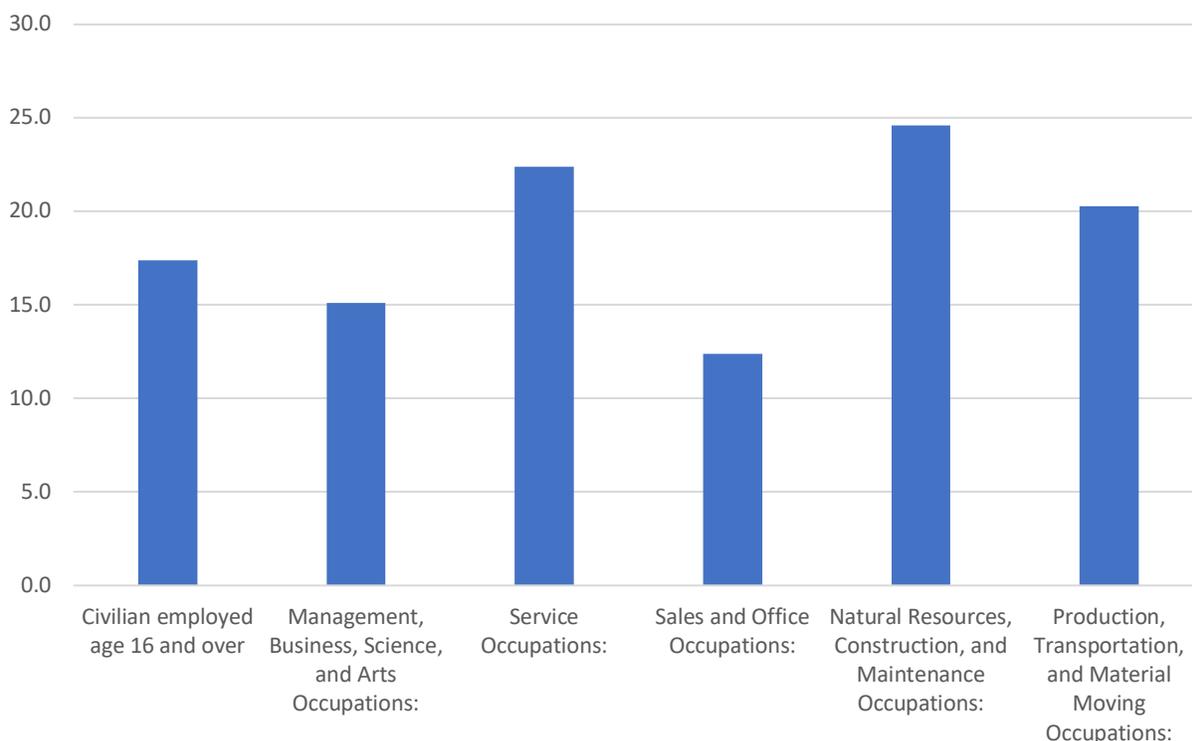
When focusing our analysis on MSAs we use projections from state Labor Departments that are compiled by The Projections Management Partnership.

Immigrant shares of occupations

For each occupation, we calculate the share of workers that are foreign-born using data from the 2019 American Community Survey. We use the historical reliance of each occupation on foreign-born labor as a guide for future immigrant needs. Figure 5 shows that migrants play a particularly key role in

(i) services occupations, (ii) natural resources, construction, and maintenance occupations, and (iii) production, transportation, and material moving occupations.

Figure 5. Percentage of foreign-born workers by occupation category, 2019



Note: This figure visualizes, for each occupational category in the U.S., the percentage of workers that are foreign-born.

Data source: U.S. census

Training requirements

We also exploit data on the extent to which occupations require extensive training and preparation to characterize the background that immigrant workers will need to fill certain labor supply shortages. Here we rely on the Occupational Information Network (O*NET) developed under the sponsorship of the U.S. Department of Labor. The O*NET database contains hundreds of standardized and occupation-specific descriptors covering almost 1,000 U.S. occupations.

We focus on O*NET Job Zones, which place occupations within one of five groups based on the training the occupation requires, where “Job Zone Five” requires extensive training and “Job Zone One” requires little to no training.

To illustrate, computer occupations are in Job Zone Four, as they require considerable training, whereas Grounds Maintenance Workers belong to Job Zone One where little or no training is needed.

Visualizing the network

In this section, we present the Occupation Opportunity Network (OON) which brings the data elements above into a framework to understand the highest-value areas of the labor market for immigration reforms targeting workers with little formal education. The network assesses all occupations according to the four aspects described above. These are occupations (i) with high projected levels of growth over the next decade; (ii) that have traditionally been filled by immigrants; (iii) that are highly complementary to other occupations in the economy; and (iv) that require little or no prior specialized training.

The network is presented in Figure 6. In it, each node represents an occupation. The skeleton of the network reflects the bilateral complementarity measures detailed above. For visualization purposes, we refrain from showing the links between every pair of occupations but rather we visualize the network using the *minimum spanning tree* network approach which highlights the strongest five percent of all links in terms of their complementarity.⁴

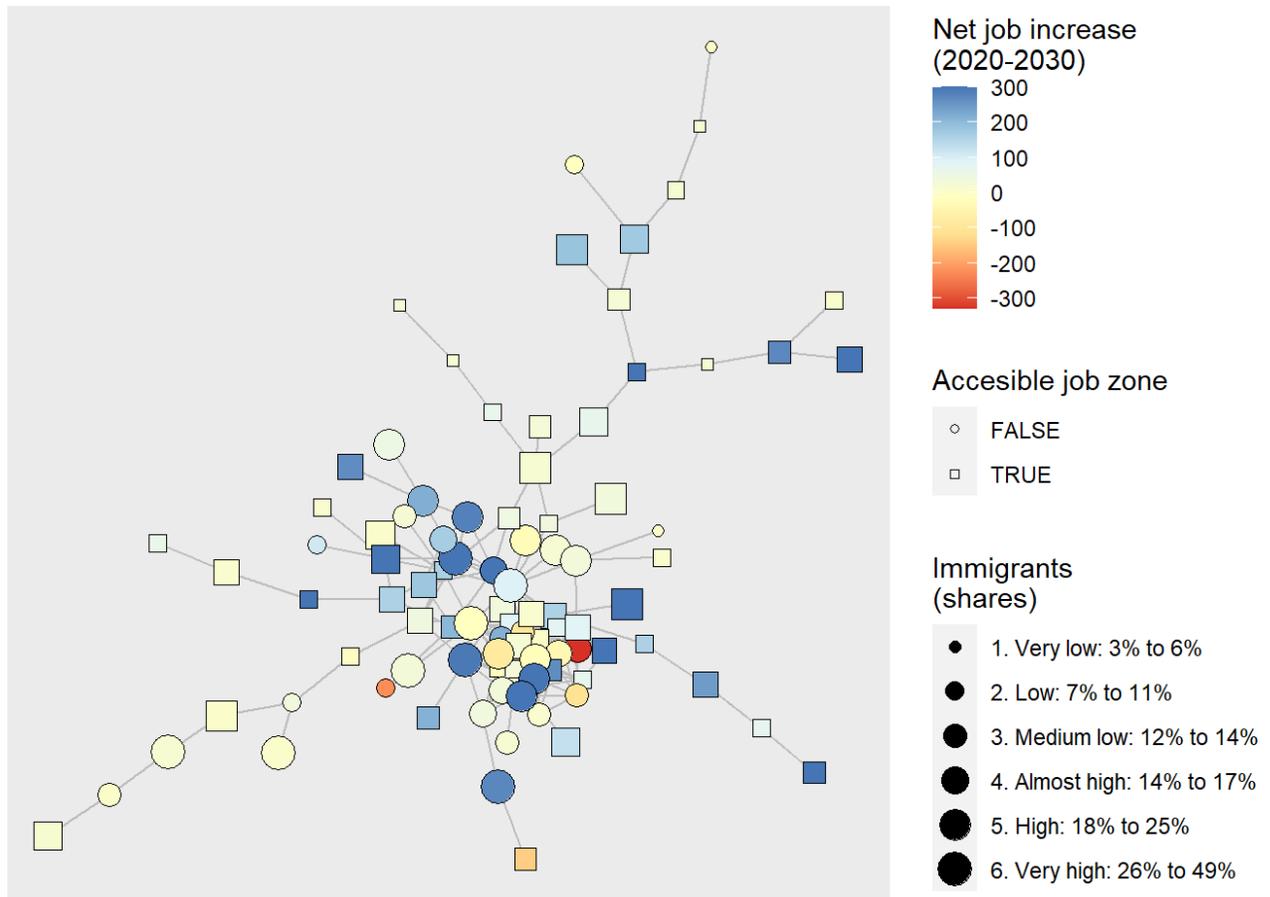
The network also includes other information. The color of the node represents the projected job growth (in thousands of jobs) over the period 2020 to 2030. The nodes –or occupations–that are in the center of the network tend to be highly complementary to all other occupations, while nodes on the outskirts of the network represent occupations that tend to have low levels of overall complementarity.

In addition, each node is represented as either a circle or a square according to whether it requires prior preparation or training according to the O*NET Job Zones indicators. Circles represent jobs that require extensive training (Job Zones Three, Four, and Five) and squares represent occupations that require little or no prior training (Job Zones One and Two).

Finally, the size of each node represents the historical immigrant intensity of the occupation. The sizes and the corresponding ranges are represented in the figure’s legend.

⁴ The design and the visualization of our Occupation Opportunity Network, and the underlying complementarity measure, is highly inspired by and adapted from the work of Hidalgo et al. (2007) and Hausmann et al. (2014).

Figure 6. The Occupation Opportunity Network



Note: This figure presents the Occupational Opportunity Network, or OON. Each node represents an occupation.

Source: Report authors

The highest-value targets for raising productivity through increased immigration are (i) toward the center of the network (highly complementary), (ii) large (immigrant intensive), and (iii) blue (projected to grow rapidly). Finally, square nodes represent occupations that *do not* require specialized training while circle nodes do. For instance, if not required then immigrants could potentially “hit the ground running,” whereas if formal preparation is required then policymakers may want to consider training programs such as Global Skills Partnerships in which immigrants receive training prior to arriving in the U.S.⁵

⁵ Michael Clemens and Katelyn Gough, “Global Skill Partnerships: A Proposal for Technical Training in Settings of Forced Displacement,” n.d., 45.

For example, “cooks and food preparation” workers is one of the largest squares in the middle of the network. Its overall complementarity measure is 0.24, among the highest of all occupations reflecting the obvious centrality of food-making to the economy. This occupation is also projected to grow significantly over the next 10 years in the United States, adding nearly 650 thousand workers. At a national level, about 26 percent of all workers in this occupation are foreign-born, indicating that future growth in these jobs will rely heavily on a growing immigrant labor force. Finally, this is an occupation that requires little training, and therefore immigrants arriving in the U.S. could easily fill these positions.

Other occupations in our framework that have similar characteristics (high complementarity, high labor demand, reliance on foreign-born workers, and little to no preparation needed) include other occupations in the food industry (e.g., waiters), as well as construction workers and transportation workers. Given the centrality of these occupations to the economy based on the OON metric, it is no surprise that there has been a shortage of these types of front-line workers in the aftermath of the COVID-19 pandemic. The high degree of complementarity with other occupations also indicates that job growth more broadly is being constrained by these shortages.

Another interesting but different example is “computer occupations,” also located in the center of the network with an overall complementarity of 0.19. This occupation is projected to grow significantly, adding nearly 670 thousand workers over the next decade, and 27 percent of its workers are foreign-born. The key difference with *cooks and food preparation workers* is simply that the node denoted by a circle, implying that workers need considerable preparation for the job. Other occupations that fall in this category (in high demand, with a high share of immigrants, highly complementarity, but with significant training needed) include health workers, financial specialists, and vehicle mechanics.

Application to local economies

One benefit of our approach is that it can be easily adapted to local economies for the use of local governments and policymakers. To do this, we use values that are specific to Metropolitan Statistical Areas (MSAs). Specifically, we use labor demand projections at the MSA level, marked by the color of the nodes, and the baseline share of foreign-born workers in an MSA for each occupation, represented by the size of the nodes. The complementarity measures and the training characteristics are unchanged because they do not depend on local economic conditions.

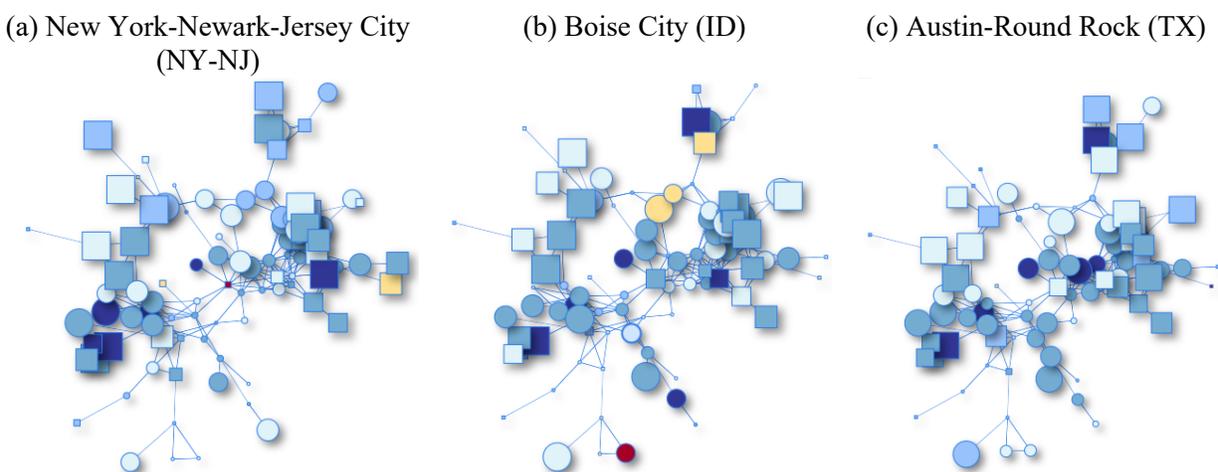
Figure 7 presents the OON for three quite different MSAs: panel (a) for New York-Newark-Jersey City (NY-NJ) area; panel (b) for Boise City (ID); and panel (c) for Austin-Round Rock (TX).

As can be seen in the figure, the skeleton of the network is the same, but as explained above, the size of the nodes (representing the share of foreign-born workers) and the color (representing projected demand) varies by city, allowing local policymakers to better understand their own landscape.

First, all three cities tend to have many occupations in which foreign-born workers are an important part of the workforce, as there are several large nodes throughout each network. Second, labor demand projections are often quite different. In the case of Boise City, for instance, there are many more instances where we can expect a downturn in labor demand for occupations such as scientists and law enforcement officers. In the case of Austin-Round Rock, all occupations are on the rise, whereas in the case of New York-Newark-Jersey City, we can expect a downturn in labor demand for occupations such as secretaries, printing workers, and communication equipment operators.

Some occupations are in high demand in all three cities, such as *cooks and food preparation workers*, for instance. Interestingly, in all three cities, a large share of cooks is foreign-born (an astounding 58 percent in NY-NJ, 19 percent in Boise City, and 29 percent in Austin-Round Rock).

Figure 7. The Occupation Opportunity Network at the city level



Source: Report authors

Since migration policy is primarily set at the federal level, this report focuses on national-level indicators to provide overall policy guidance. However,

looking at policy implications for states, commuting zones, or cities is an essential part of our ongoing policy research agenda.

Immigration and the Occupation Opportunity Network

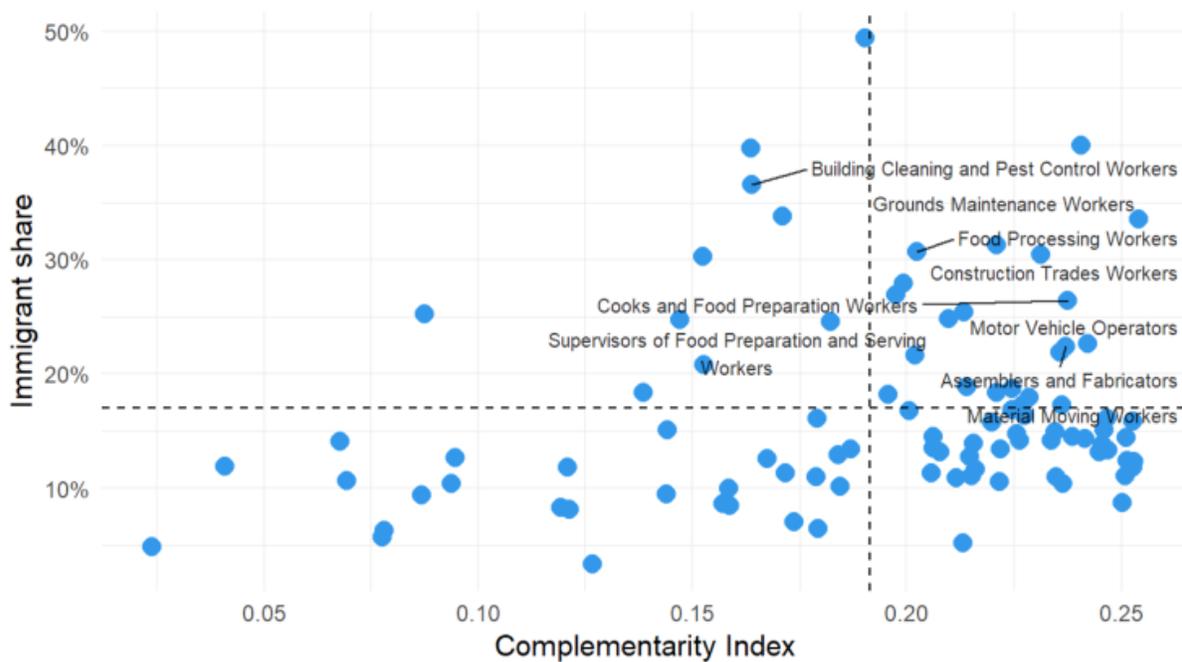
Figure 8 below depicts the relationship between overall complementarity and the reliance of each occupation on the immigrant workforce. The vertical axis measures the share of all workers in an occupation that was born abroad, and the horizontal axis tracks our complementarity index.

Overall, the pattern in the figure indicates that immigrants tend to work in occupations that are more central to the overall workforce, in effect supporting millions of American workers.

This is consistent with the literature, which often finds little or no effect of low-education immigrant inflows on native outcomes. While in some cases immigrants may crowd out native-born workers, they are also raising overall productivity and job creation through their complementarity with other types of work. In fact, this is consistent with evidence that, on average, immigrants may generate upward economic mobility for many native-born workers.⁶

⁶ Giovanni Peri, "The Effect Of Immigration On Productivity: Evidence From U.S. States," *Review of Economics and Statistics* 94, no. 1 (February 2012): 348–58, https://doi.org/10.1162/REST_a_00137.

Figure 8. Overall complementarity and the reliance of each occupation on the immigrant workforce



Source: Report authors

The relationship is even more remarkable when looking at occupations classified in “Job Zone One” or “Job Zone Two”, which are occupations for which workers need little to no prior training. These occupations are fundamental to the economy in terms of their overall complementarity and many of them have a share of foreign-born workers that is much higher than the average in the economy of about 17 percent. In fact, foreign-born workers in the top 10 occupations in Job Zones One and Two represent about 19 percent of the workforce.

This figure supports the notion that immigrants work in occupations that are central to the economy.

Policy insights

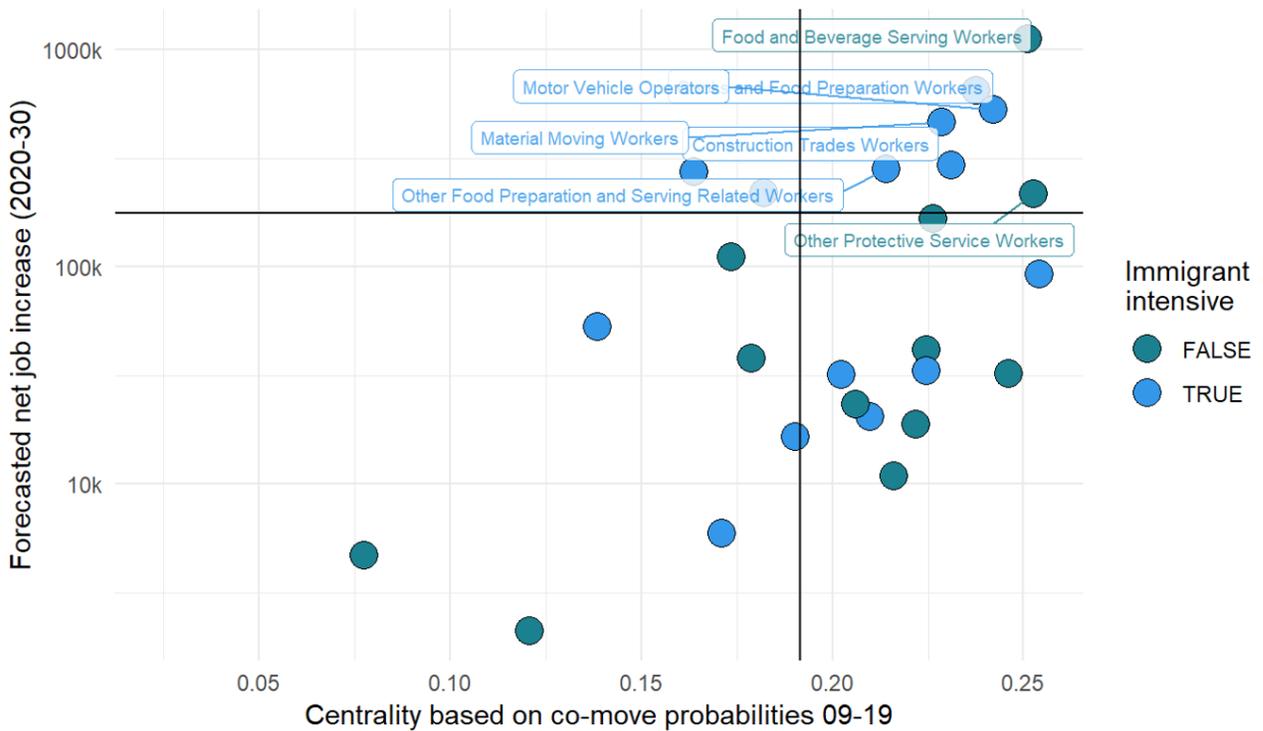
This framework provides a guide for policymakers to identify the occupations that require the most attention in the context of U.S. immigration policy over the next decade. To do that, we incorporate all the variables that we used in the network above to produce two different sets of policy recommendations, first for occupations that do not require prior training and, second, for those that do.

Occupations that do not require prior training

Figure 9 presents a scatter plot in which each observation is an occupation. The horizontal axis measures the overall complementarity of the occupation based on the measure described above and the vertical axis measures the projected demand for those occupations between 2020 to 2030, also described above.

The color of the observations mark whether such occupation is “immigrant intensive,” meaning that the share of foreign-born workers in that occupation in 2019 was above or below 17 percent, which corresponds to the national average for foreign-born workers. Blue dots are immigrant intensive while green dots are not. Of course, the fact that a particular occupation historically had a large share of foreign-born workers does not mean that in the future that pattern will remain the same, but it is informative about the type of work that the U.S. economy currently relies on immigrant workers to do. Given the labor market forecast for the next ten years, it is important to recognize that foreign-born workers will continue to be an important part of the workforce absent drastic changes to the U.S. labor market.

Figure 9. Overall complementarity (centrality) and forecasted growth



Source: Report authors

The figure is divided into four quarters. The horizontal axis marks the 25th percentile of employment growth, while the vertical line is the mean of the overall complementarity measure. We thus focus on all observations in the upper right quadrant of the graph, which are occupations that are forecast to see rapid growth and, at the same time, are highly complementary to the existing workforce.

Table 2 lists those occupations in the upper right quadrant, which are the ones we believe deserve the most focus in terms of their needs, their overall complementarity, and the large historical reliance on immigrants in some cases. These occupations do not need extended preparation or training so that immigrants with little to no formal training could fill the demand for these positions.

Table 2. Fast-growing, immigrant-intensive occupations

Occupation	Forecast Growth 2020-2030	Jobs in 2020	Overall Complementarity	% Foreign-born workers (2019)
Food and Beverage Serving Workers	1119.7 k	6135.7 k	0.251	14.50
Cooks and Food Preparation Workers	647.2 k	2977.7 k	0.238	26.40
Motor Vehicle Operators	528.8 k	3976.4 k	0.242	22.60
Material Moving Workers	465.3 k	6921.9 k	0.228	18.00
Construction Trades Workers	294 k	4430.3 k	0.231	30.40
Other Food Preparation and Serving Related Workers	281.8 k	1156.4 k	0.214	18.90
Other Protective Service Workers	217.4 k	1495.9 k	0.253	11.80

Source: Report authors

An initial step could be to start with low-hanging fruit like the Farm Workforce Modernization Act, a bill proposed in the House by Republican Dan Newhouse. This would provide a wide range of benefits including reducing food prices and ensuring migrant farmworkers are documented.

Congress should also expand the H-2B visa cap for non-agriculture temporary workers while also allowing for approval of multiple years of employment to reduce the burden on firms from the annual application process. As of today, the program is capped at 66 thousand visas per year, which is clearly far too small, even in the context of the occupations listed above that require only seasonal work such as those in sectors like construction or hospitality.

However, the H-2B is clearly insufficient for occupations and employers with longer-term employment horizons and there are few other tools that can be used by employers to sponsor immigrants with low levels of formal education. To address this, the U.S. should start by approving asylum claims at a far higher rate, as thousands of deserving applicants are currently denied or wrongly expelled. This would require increasing funding for all agencies responsible for the processing of asylum seekers and streamlining the inter-agency asylum process and provision of wraparound services. Admitting additional asylum seekers would serve both labor market and humanitarian goals.

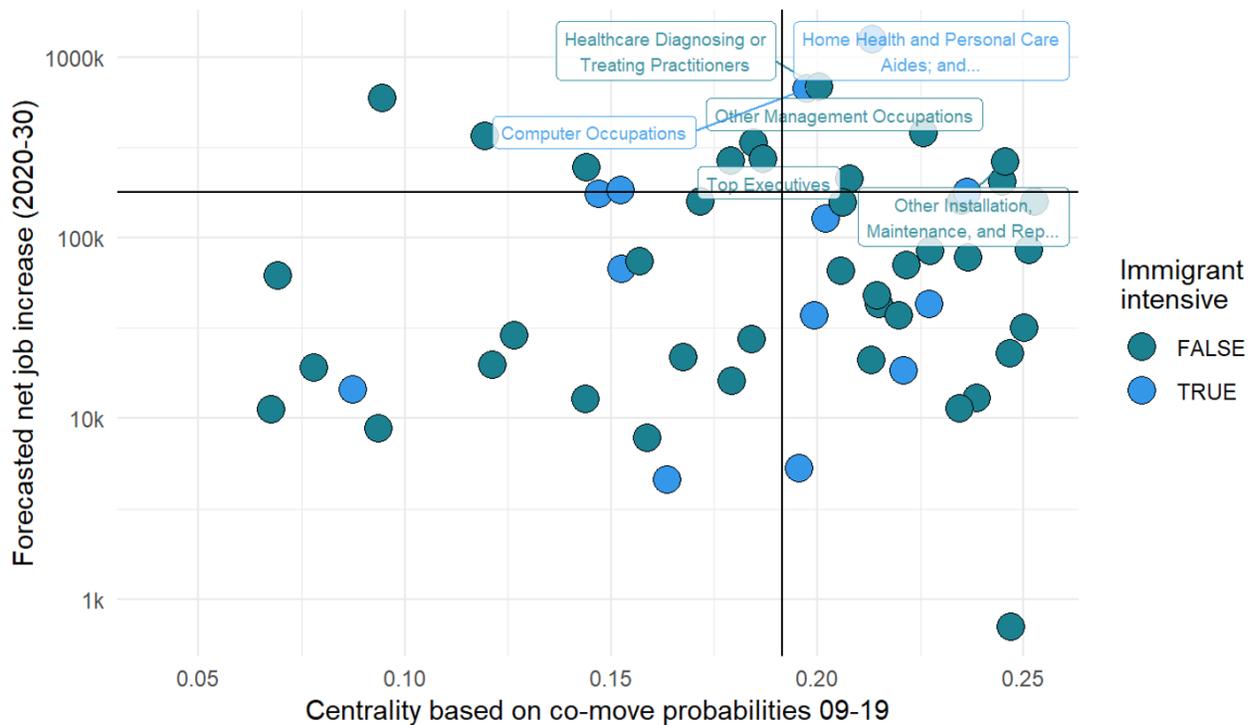
Another option would be to add state-based visas to the policy toolkit. Congressional legislation to pilot this type of visa program has been proposed previously. State-based visas would allow states to issue temporary or

permanent work visas (depending on the legislation), giving them the flexibility to admit the number of immigrants that serve state-level needs. Benefits include the ability to more easily target regions of the country with labor supply shortages; the potential for an easing of undocumented border crossings; and the potential to lower the temperature on the immigration debate by giving states more control over immigration policy. In fact, similar policies are in place in Canada and Australia and could be adapted for the U.S. The primary downside is that this policy also restricts the movement of immigrants within the country, which would be costly.

Occupations for which prior and substantive training is required

Figure 9 below presents an analogous visualization but focuses on occupations that require significant prior training (those in Job Zones Three to Five), which are also in high demand, and are highly complementary to the overall workforce. Again, our focus is on the occupations in the upper right quadrant. As can be seen, some of these occupations are intensive in foreign-born workers, having a share of immigrant workers that exceeds the national share of 17 percent as of 2019.

Figure 10. Overall complementarity (centrality) and forecasted growth, training required



Source: Report authors

Table 3 below lists eight occupations that make the cut according to our analysis, sorted from largest to smallest in terms of their forecast growth until 2030. The first two in the list are “home health and personal care aides; and nursing assistants, orderlies, and psychiatric aides” and “health care diagnosing or treating practitioners.” This is not a surprise given that healthcare workers are in high demand and immigrants could play a significant role in filling those vacancies. In fact, over 25 and 16 percent of all workers in those two occupations were foreign-born. They are also very large occupations—with about 10 million jobs combined in 2020—and are expected to grow by nearly 2 million over the next decade. Both are highly complementary occupations to the workforce in general.

“Personal care and service workers” also make the list and will grow by nearly 180 thousand workers by 2030, up from the current 2.4 million.

Table 3. Fast-growing, immigrant-intensive occupations, training required

Occupation	Forecast Growth 2020-2030	Jobs in 2020	Overall Complementarity	% Foreign-born workers (2019)
Home Health and Personal Care Aides; and Nursing Assistants, Orderlies, and Psychiatric Aides	1252.4 k	4677.8 k	0.213	25.40
Health care Diagnosing or Treating Practitioners	685.9 k	5611.6 k	0.201	16.70
Computer Occupations	667.6 k	4368 k	0.197	26.90
Other Management Occupations	377 k	2569.9 k	0.226	14.70
Other Installation, Maintenance, and Repair Occupations	265.2 k	2932.8 k	0.246	13.90
Top Executives	213.4 k	2601.1 k	0.208	13.20
Other Teachers and Instructors	204.7 k	1086.8 k	0.245	13.20
Other Personal Care and Service Workers	179.4 k	2401.7 k	0.236	17.30

Source: Report authors

Our analysis offers important directions for migration policy over the next decade, as the U.S. government must plan enough legal pathways to attract immigrants to fill the demand in these fast-growing occupations. If we combine forecast growth with the current immigrant shares and focus only on the list in Table 3, the U.S. will require nearly 800 thousand additional high-skilled, immigrant workers. And this does not include any of the other occupations that will also need foreign workers.

As of today, the H-1B visa program—the visa for high-skill workers in the U.S.—is capped at 65 thousand workers a year, plus another 20 thousand workers who had completed graduate school in the U.S. This cap has not been adjusted since the early 2000s, despite economic growth and the natural growth of the workforce. Companies in the need of these workers, particularly the ones in our list which include occupations that are highly complementary to the workforce, will not be able to meet demand without a significant increase in the cap for these workers, affecting the U.S. economy at large.

The nature of these occupations also makes them a perfect candidate for the Global Skills Partnership concept envisioned by Michael Clemens (CITE). Clemens proposes that as part of its global development strategy the U.S. could invest in the skills of *potential* immigrants while they are still in their home countries and could specifically target the skills needed to fill high-demand jobs in the U.S. This training could then be linked to visa programs in a way that is coherent and consistent with those needs. Our framework provides a guide for identifying the jobs that could be targeted in such a program.

Conclusions

A thriving workforce will always be growing, as new workers enter to fill opportunities at the bottom rungs of the career ladder and more experienced workers move up. But this process has broken down, with strong upward mobility for U.S. workers over the past two years leaving few workers willing to do relatively low-paid work. In some sectors—like child care and hospitality—this has been the situation for many years but has reached extreme levels post-pandemic. These sectors, and others, are now entirely dysfunctional, supplying far fewer of their services than are demanded. This represents a significant loss for society and could be easily fixed by relaxing any number of constraints on current levels of immigration.

We have also shown that this problem will only worsen, as BLS estimates of employment growth over the next 10 years will be disproportionately within immigrant-intensive occupations. This is potentially a crisis in the making given that severe labor shortages will raise prices; reduce women’s labor supply; reduce the quantity and quality of child and elder care; reduce the competitiveness of U.S. innovation; hamper small business growth; and reduce the variety of goods and services, among other outcomes. In short, without a significant increase in immigration over the next few years, Americans’ standard of living will fall.

This report has highlighted these problems while also providing a guide to understanding where the greatest labor market pressures currently are and where they will grow over the next decade. We hope that our Occupational Opportunity Network and the broader discussion presented here can be useful for motivating and directing needed immigration policy.

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Appendix

Complementarity measure

The first step to compute the share of employment of each occupation in each industry is as follows:

$$share_{iot} = \frac{E_{iot}}{\sum_o E_{iot}}$$

Where i indexes an industry, o indexes an occupation, and t indexes time. With our time variation, we then can compute for each occupation and industry the difference in shares, organized in an industry-occupation matrix, defined as:

$$\Delta_{iot} = share_{io,2019} - share_{io,2009}$$

We then create two binary matrices. The first one, $M_{io}^{increase}$ where entries are defined as 1 if the share of occupation o in industry i increased between 2009 and 2019, or 0 if otherwise. Formally:

$$M_{io}^{increase} = \begin{cases} 1 & \text{if } \Delta_{io} > 0 \\ 0 & \text{if otherwise} \end{cases}$$

We also create a second matrix, $M_{io}^{decrease}$, where entries are defined as 1 if the share of occupation o in industry i decreased between 2009 and 2019, or 0 if otherwise. Formally:

$$M_{io}^{decrease} = \begin{cases} 1 & \text{if } \Delta_{io} < 0 \\ 0 & \text{if otherwise} \end{cases}$$

Matrix $M_{io}^{increase}$ is used to create an occupation-occupation matrix, $\Phi_{o,o'}^{increase}$, where each cell represents the minimum probability that occupations o and o' increased their shares within the same industry, across all industries. Formally:

$$\Phi_{o,o'}^{increase} = \min \{P(M_{io}^{increase} = 1 | M_{io'}^{increase} = 1), \{P(M_{io'}^{increase} = 1 | M_{io}^{increase} = 1)\}$$

Analogously, we do the same thing using matrix $M_{io}^{decrease}$ as an input to compute the analogous matrix $\Phi_{o,o'}^{decrease}$.

These two matrices capture the complementarity of two occupations. The first one $M_{io}^{increase}$ is based on two occupations growing in shares at the same time within an industry, while the second one, $M_{io}^{decrease}$, is based on two occupations shrinking at the same time. This is important because we want to capture complementarity using both mechanisms.

Then, we come up with a single complementarity measure, matrix $\Phi_{o,o'}$, which takes the minimum value between the two matrices described above. Formally:

$$\Phi_{o,o'} = \min (\Phi_{o,o'}^{increase}, \Phi_{o,o'}^{decrease})$$

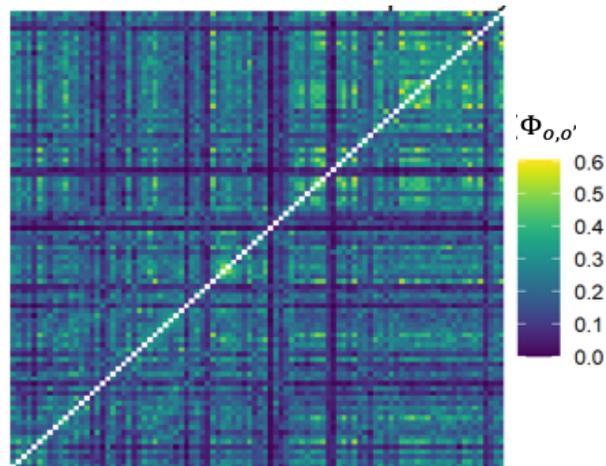
By taking the minimum we are being conservative in constructing our measure.

$\Phi_{o,o'}$ is the main component of our network. A visualization of this occupation-occupation matrix is presented in Figure A1, where darker colors imply less complementarity and lighter (yellow) colors represent more complementarity between occupations, according to our measure. Its values, being a probability, distribute between zero and one. Figure A2 visualizes the distribution of $\Phi_{o,o'}$, where values distribute between 0 and 0.8, though $\Phi_{o,o'}$ 0.4 approximately.⁷

Note that our method to compute complementarity is highly inspired by and adapted from the work of Hidalgo et al. (2007) and Hausmann et al. (2014) who compute measures of proximity between industries based on the countries that export them.

⁷ Throughout our attempts to create a complementarity measure between occupations, we also tried a measure that exploits the continuity of the data when it comes the change in shares, by computing a measure that correlates between the change in shares between 2009 and 2019 across occupations for all. However, using this measure, high positive correlation coefficients would indicate that occupations grew significantly across industries, while negative coefficients would indicate that occupation shares for the most part went in different directions over time. However, this metric presents an important disadvantage: it is biased towards occupation pairs with substantial changes in shares, which in turn is typically common among small occupations. Despite this bias, we do find consistencies. Therefore, we decided to use the measure explained above.

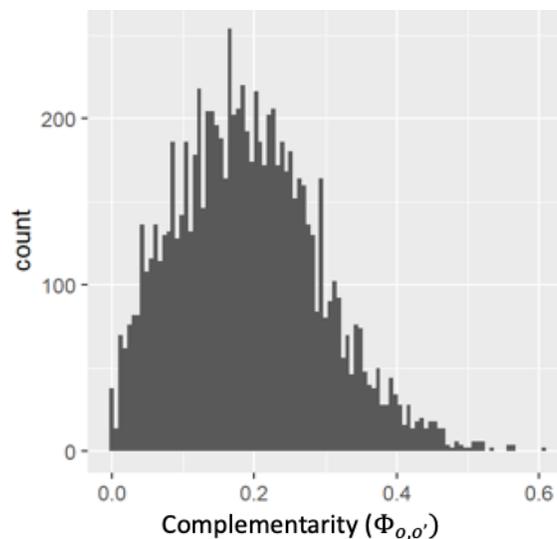
Figure A1: Pairwise complementarity



Note: This figure visualizes the $\Phi_{o,o'}$ matrix, with each cell representing an occupation-occupation pair. The diagonal is blank as we do not compute the complementarity of an occupation with itself.

Source: Authors' calculation.

Figure A2: Occupation Complementarity Distribution



Note: This figure visualizes the distribution of the values of the matrix.

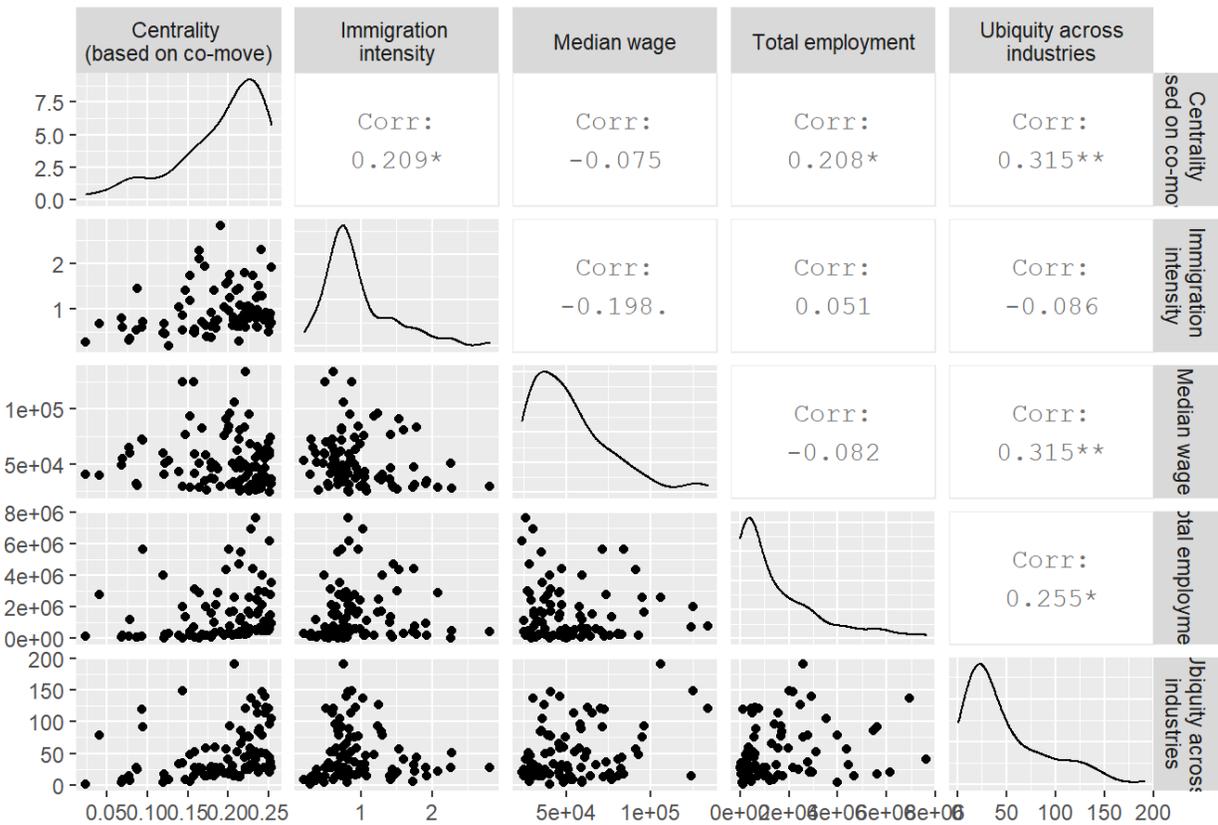
Source: Authors' calculation.

With these measures, we can create an overall complementarity index (or centrality) by simply averaging for each occupation all the bilateral complementarities with each other occupation. Thus, if the measure of overall complementarity for a given occupation is, say, 0.23, it could be interpreted as when that occupation grows in share, on average, 23 percent of all other

occupations also grow. Occupations with high levels of overall complementarity tend to be occupations that are quite central in the workforce.

Figure A3 presents some basic correlations between our measure of overall complementarity and other characteristics of the occupation. In it, we find a positive and significant correlation with immigration intensity; a slightly negative correlation with median wages for that occupation, though not statistically significant; a positive and significant correlation with the total number of employees in that occupation (e.g., complementary occupations employ more people); and a positive and significant correlation between overall complementarity and ubiquity of the occupation (defined as the extent to which that occupation is present in a large number of industries), which simply implies that occupations that are present in more industries are typically more central to the economy.

Figure A3: Correlations between overall complementarity and occupations characteristics



Note: This figure visualizes the correlations between our measure of overall complementarity for occupations against a number of other occupation-level characteristics.

Source: Authors' calculation.

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