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The Gift of Global Talent: Innovation Policy and the Economy

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Executive Summary

Talent is the most precious resource for today's knowledge-based economy, and a significant share of the US skilled workforce in technology fields is foreign born. The United States has long held a leading position in attracting global talent, but the gap between the United States and other countries is shrinking. Immigration policies like the H-1B visa program shape the admissions of foreign workers to the country and grant a particularly strong gatekeeping role to sponsoring firms and universities. This chapter explores the data around global talent flows and some of the economic implications of an employer-driven immigration approach.

I. Introduction

In today's knowledge-based economy, high-skilled workers are arguably the most important resource to the success of businesses, regions, and industries. Historical industrial powerhouses focused on access to natural resources like harbors, waterways, and mines, but Silicon Valley, the center of tech and innovation in America, was barely on the map a few decades ago. Moreover, the talent that fuels the Valley and other tech clusters comes from all across the country and the globe. Skilled and innovative individuals are frequently willing to uproot their lives to be where the action is and even pay the exorbitant rent prices and cost of living once there.

Much of that action over the last century has been in the United States, and this privileged spot shows in the data. Immigrants accounted for about 17% of the high-skilled, employed, male population in 2017. In science, technology, engineering, and mathematics (STEM) occupations, there are twice as many immigrant workers per capita. Immigrants are even more overly represented at the top of the education pyramid (greater than half of US doctorate holders) and in the ranks of entrepreneurs. As nations race for global talent in the decades ahead, increased attention will focus on policies that govern the flows of high-skilled migrants.

Employment opportunities are the central reason for most long-term migration of talented individuals to America. Some of these individuals first arrive in the United States to study at an American university, often entering the country initially on an F1 visa. Following graduation, many transition to the workforce through either the Optional Practical Training (OPT) program or an employer sponsored H-1B visa. Others move to the United States after finishing their education abroad, either in their home country or in a third transition country. For these high-skilled workers and absent the occasional marriage to an American, university- and employer-based visas represent the primary path to access America and potentially a green card.

This chapter focuses on skilled worker migration, typically through school and work channels, for a few reasons. The policies that govern these types of admissions are distinct from those supporting migration for family reunification or refugee/asylum. The economics and societal consequences of high-skilled migration are also unique, and the political environment surrounding high-skilled immigration is less divisive. A recent Politico poll reports that Americans are three times more likely to support the immigration of "high-skilled workers" than "low-skilled workers," and a majority of support exists in most every way the data are cut (e.g., Republican versus Democrat, rural versus urban).[1] Kerr, Kerr, and Lincoln (2015a) review recent academic literature on these differences, and this chapter's focus of talent flows allows it to provide a more concrete discussion. These policies appear the most likely politically to result in initial agreement.

In *The Gift of Global Talent: How Migration Shapes Business, Economy, and Society* (Kerr 2019), I provide a comprehensive portrait of high-skilled immigration flows, mixing economic, business, and policy elements for the United States and foreign countries. This chapter reflects some of the early elements of the book on how researchers define and measure high-skilled workers in emerging data, how these valuable workers migrate around the world, the policy environment that characterizes the United States, and the impact that high-skilled immigration has on US growth and innovation.

II.   High-Skilled Migration and Its Measurement

A.   *How to Define High-Skilled Workers*

When seeking to measure talented individuals, it's impossible to find a perfect match in the data. Talent is a spectrum that draws on both

education and innate talent, and no single common denominator (e.g., a college education) captures all of the important variants or pathways taken in school and work. Instead, we analyze various groups that are considered to be highly skilled, tracing their paths from country of birth to the United States. These groups are important for policy discussions relating to student and high-skilled, employment-based migration.

We analyze trends for three groups that can be ranked in an approximate order based on talent level. The first group we study includes Nobel prize winners.[2] Utilizing individual-level data for the Nobel prizes in Chemistry, Medicine, or Physics, which have been awarded since 1901, and for Economic Sciences, which has been awarded since 1969, we track some of the world's most talented researchers for over 100 years (Kerr et al. 2016).[3] Data from these fields of the Nobel prize are especially useful for studying high-skilled migration because records identify both the winner's country of origin and place of work for more than a century.

The second group we consider includes inventors. The World Intellectual Property Organization (WIPO) collects global data on patents and inventors that include inventor nationalities. This data set combines information from intellectual property offices around the world to allow for a direct comparison across countries. In addition, the United States Patent and Trademark Office (USPTO) offers data over a longer period of time and allows for additional analysis focused on US invention. Inventors give us a broader picture of high-skilled individuals than the elite extremes of Nobel prize winners.

The final group we consider for describing high-skilled migration is college graduates. This group is the largest of the three, but perhaps surprisingly it is the least precise. The Organization for Economic Cooperation and Development (OECD), the World Bank, and the International Migration Institute at Oxford University have recently built a massive data set that incorporates immigration and census records from around the world. The result is the richest database to date on education levels and immigration. The data focused on 29 OECD member states (hereafter referred to as "the OECD data") are the most reliable from this data set and include advanced nations in Europe, North America, and Asia. Migrant inflows to these countries include nearly every country in the world.

To provide a sense of the size of each group, the Nobel prize data include 661 individuals, the WIPO inventor data contain over 6 million inventor records at the end of 2012, and the OECD data track the approximately 28 million college-educated immigrants residing in the OECD in 2010. Of these 28 million, nearly two thirds were born outside of the

OECD, and China, India, and the Philippines alone account for 5 million. Other countries have also rapidly increased the number of skilled workers they send abroad. Algeria (954% increase), Russia (910%), Bangladesh (459%), Romania (428%), Venezuela (423%), Ukraine (385%), and Pakistan (380%) had the largest increases in high-skilled emigration between 1990 and 2010.

In total, high-skilled migration rates have been rising rapidly, with a 185% increase in total talent flows from non-OECD countries (Kerr et al. 2016). The composition of sending countries has changed dramatically over that time period. In many countries where natural population growth has stagnated because of demographic transitions and aging populations, non-OECD, college-educated immigrants are the most important contributors to an expanding high-skilled workforce.

B.   Patterns in Talent Flows

Despite the very different groups described earlier—with Nobel prize winners to inventors to college-educated workers showing lower talent levels but increased group sizes—there are very regular patterns that commonly emerge across them. These regularities are important for describing the common features of the migration of talented individuals.

C.   Migration Rates Increase in the Talent Levels of Individuals

High-skilled individuals migrate much more frequently than the general population. A steady rate of approximately 3% of the world's population has lived outside of its country of birth since the 1960s (World Bank Open Data 2019a, 2019b). Although that figure has been roughly constant for more than 60 years, the world's population has more than doubled from 3 billion to more than 7 billion, meaning that the absolute count of migrants has also more than doubled. A United Nations' estimate from 2015 places the world migrant count at 224 million (United Nations 2016). Only about 8%, or 20 million, of those migrants are refugees. In comparison with other factors that move around the world today, the total migration of people is only about a tenth of that of exports, which account for 30% of global gross domestic product (World Bank Open Data 2017). Finance is also more globally integrated than are people flows.

Given a general rate of 3% migration, there are important differences by skill level. In terms of education, those with college degrees are roughly three times more likely to migrate than those with only a secondary level of education. The specific numbers are not easy to align

across sources, but one team measured that 5.4% of college-educated individuals migrate compared with only 1.8% of those who have a secondary-level education and 1.1% for those with lower education levels (Docquier and Marfouk 2006).[4]

Moving up a skill level, the WIPO data estimate that 10% of worldwide inventors between 2000 and 2010 were migrants (Miguelez and Fink 2013). Because of the way these data are collected, the precise interpretation is that one of every ten inventors active between 2000 and 2010 was not a citizen of the country where the invention was patented. As migrants can become naturalized citizens, this measure will thus underestimate somewhat migration rates of inventors. Looking at just the most talented inventors as measured by the impact of their patents on subsequent knowledge development, the rate of migration again increases by productivity. The top 5% of inventors, those with about 200 or more citation-weighted patents, are about five times more likely to migrate than less productive inventors (Akcigit, Baslandze, and Stantcheva 2016).

Our smallest and most talented group, Nobel prize winners, boasts the highest migration rate. Scientists working outside of their country of birth account for a third of Nobel prizes in Chemistry, Medicine, Physics, and Economic Sciences since 1901 (i.e., 203 of 661 individuals). This demonstrates a continuum across talent levels, as shown in table 1. The rate of migration for Nobel prize winners is approximately 17 times higher than the rate for high school graduates.

D.   A Few Advanced Economies, Especially America, Receive Most of These Talented Migrants

Having established that higher-skilled individuals are more likely to migrate than lower-skilled workers, the next question is, Where are they

Table 1
Global Movement of Talent by Skill Level

	Nobel Laureates 1990–2016 (%)	WIPO Inventors 2000–2010 (%)	College Educated ~2010 (%)
Global migrants as a percentage of total group worldwide	31	10	5
Share of global migrants moving to United States	53	57	41
Immigrants as a share of the United States' group	33	18	17

Sources: Data from Nobel prize records, Miguelez and Fink (2013), Kerr et al. (2016), and Hanson and Liu (2018).
Note: WIPO, World Intellectual Property Organization.

going? Most of them end up in advanced economies and especially in the United States. Only 20% of the world's population lives in OECD nations, but these countries are home to more than two thirds of the world's college-educated migrants. The United States has historically captured more than half of migrants from OECD nations, though that share has recently fallen to around 40%. From a global perspective, the United States is home to over 11 million skilled migrants, about one third of the total. The other top receiving countries include the United Kingdom, Canada, and Australia, which collectively attract about 25% of migration from OECD nations (Kerr et al. 2016). In contrast to this concentration in advanced economies, lower-skilled migration is much more diffuse and not associated with a specific set of countries. One reason for this is the weaker cost-benefit ratio of long-distance moves for lower-skilled workers compared with top talent.

Within individual destination counties, stark imbalances also exist for the placement of global talent. In the United States, New York City and Silicon Valley together hosted about one-eighth of all STEM workers in 2013 (Silicon Valley Leadership Group and Silicon Valley Community Foundation 2015). Furthermore, in 2013, 56% of STEM workers and 70% of software engineers in Silicon Valley were born outside of America (Kerr et al. 2016).

These locations are frequently labeled as talent clusters and represent places where the productivity of high-skilled workers is greatly enhanced by proximity to other high-skilled workers.[5] This increased productivity can result from an industry's dependence on specialized knowledge transfers and interactions (e.g., the biotech industry in Boston), the ability to leverage professional networks among top firms (e.g., the advertising industry in New York), the potential to find the best match between firms and talented individuals (e.g., the movie industry in Hollywood), or the unique ethos of the ecosystem (e.g., the daring start-up culture of Silicon Valley). Moreover, talent clusters are able to push the boundaries of innovation by selecting the best of the best ideas.

Among migrating inventors, the preferential position of the United States becomes even starker. The top four countries in terms of immigrant inventors are the United States, Germany, Switzerland, and the United Kingdom. Together, these countries account for 65% of immigrant inventors. Figure 1 shows, however, that the United States alone accounts for 57% of this total, with immigrant inventors coming to America from around the globe. The pull is so strong that countries like Germany and the United Kingdom send more people abroad (most to the
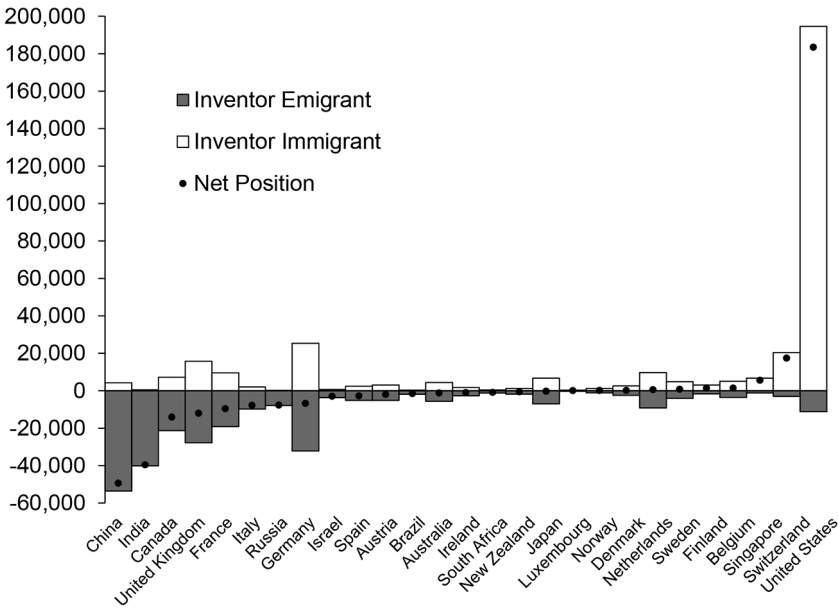
Fig. 1.   Global migration of inventors during 2000–2010.

Sources: Data from World Intellectual Property Organization and Miguelez and Fink (2013).

United States) than they receive from other nations. Other countries with high inventor outflows include China and India (Miguelez and Fink 2013; Kerr 2019).

Among the highest ranks of talent, the data are just as stark and un-ambiguous. Of the 203 migrants who received a Nobel prize in Chemistry, Medicine, Physics, or Economics, 53% (107 individuals) were residing in the United States when they did their exceptional work. In contrast, only four Americans (less than 2%) were associated with a foreign institution when they received the award.

E.   Immigrants Account for a Large Share of America's Accumulated Talent, and the Size of That Share Grows as the Level of Talent Rises

Even given the immense size of the United States, inflows of high-skilled immigrant workers still have significant effects on the economy and worker demographics. Among college-educated workers in the United States, 17% are immigrants. This is a substantial increase from their 7% share in 1980 (Hanson and Liu 2018; Ruggles et al. 2019). Focusing on

STEM workers with a college degree, 29% are foreign born. And among those who hold doctorates, immigrants account for 52%.

Turning to inventors, the WIPO data show that 18% of US-based inventors during the 2000s were citizens of another country. From the perspective of inventions, approximately one in four patented technologies had an immigrant inventor or co-inventor. Again, because of changes in citizenship, these numbers are a lower bound of total migrant contribution (Wadhwa, Jasso, et al. 2007; Wadhwa, Saxenian, et al. 2007). Finally, 33% of US-based Nobel prize winners since 1901 have been immigrants (107 of 330).

Taking a step away from these groups, the influence of immigrants on American business and culture is also visible. Many of the country's most well-known brands, from Wall Street (Goldman Sachs) to retail (Kohl's) to groceries (Kraft), are recognizable by the name of their immigrant founder. Of Fortune 500 companies, about 40% were founded by first- or second-generation immigrants (Partnership for a New American Economy 2011). In Silicon Valley, half of all engineering and technology startups are headed by immigrants. This substantial contribution to technology and business is a factor when designing policy toward high-skilled foreign workers.

F.   *Growth in Global Talent Inflows Is Often Closely Timed*
      with Stronger Participation of Skilled Natives as Well

Although the previous statistics are important in regard to levels of high-skilled immigration, trends and dynamics are also an essential piece of the discussion. Increases in high-skilled immigration are often correlated with increases in skilled work in the economy as a whole (e.g., Hunt and Gauthier-Loiselle 2010; Kerr and Lincoln 2010). Other global exchanges, such as the infusions of cheap Chinese textiles into the US market and the shuttering of US textile plants, can demonstrate the opposite pattern.

Drawing on the first case of Nobel prize winners, both immigrants and natives contributed to the increasing number of winners who claim America as their home. During the first few decades of the Nobel prize, 13% went to scientists working in the United States. Of those, immigrants accounted for about a third. Indicative of America becoming a global scientific leader in the second half of the twentieth century, 65% of Nobel prize winners since 1970 have been based in the United States,

and more than a third are immigrants. Thus, domestic winners and immigrant winners have prospered side by side.

This pattern of simultaneous immigrant and native growth for skilled work is not limited to the world's top scientists. Many cities, industries, and companies also showcase the positive effects of increased high-skilled immigrant presence. Silicon Valley boasts extraordinary levels of both high-skilled immigrants and natives. Some of the top bankers in the world call London or Hong Kong their home, regardless of their country of birth. Systematically, a correlation exists between growth rates of high-skilled immigrants and natives in most settings. Although a correlation cannot prove that immigrants help natives in a causal fashion, it provides a valuable place to begin. Potential causal mechanisms are discussed in the next section.

G.   *Talent Flows from Asia, and Especially China and India,*
      Are Surging

Migrants move around the globe along a variety of paths, some well-worn that follow historical colonization paths or connect advanced economies with a shared language, whereas others are less predictable. In the past few decades, migration paths have shifted in important ways. The open borders of the European Union have changed the migration patterns of its member states, as is also likely with the United Kingdom's possible withdrawal from the EU. Every so often, there is a large-scale exodus from a country in crisis, such as the fall of the Soviet Union or during the more recent and ongoing crisis in Venezuela.[6]

The growing influence of migrants from China and India is perhaps the greatest recent transformation. In 2010, about 3.5 million college-educated workers from China and India resided in the OECD. High-skilled immigrants from these two countries account for about 20% of the total immigrant flow from non-OECD countries. WIPO patent data report that 28% of immigrant inventors were born in either India or China. Although these statistics seem incredible for just two countries, one must not forget that China and India account for a third of the world's population.

Perhaps the most important aspects of Chinese and Indian migration are their current growth rates and future potential. For most of the twentieth century, because of isolationist governments, colonial control, and other impediments, talent born in these two nations was severely underutilized. In the 1960s, the share of Indians in US science and technology

was essentially zero but has grown to more than 9% and is likely to continue increasing at a rapid pace (Hanson and Liu 2018). Moreover, by the turn of the century, more than one in four immigrant inventors was born in either China or India.

Looking forward, much of the increasing influence of Chinese and Indian high-skilled immigrants will come through the education system.[7] Together, China and India account for half of all international students in the United States, with 350,000 and 186,000 students, respectively, in 2017. Highlighting the rapid pace at which these communities are growing, these numbers are 6.8% higher for China and 12.3% higher for India than the previous year. These students are overwhelmingly choosing programs in science and engineering, a decision that will shape the future of both the US and global workforces in the decades to come.

H.   Women Now Represent More Than Half of Global Talent Flows

Women have become an ever more important component of high-skilled immigration in recent years. The stock of high-skilled female immigrants in OECD countries grew by 152% between 1990 and 2010, from 5.7 to 14.4 million. In 2010, the stock of high-skilled female migrants surpassed that of high-skilled male migrants (Kerr et al. 2016). Although the reasons for this rapid increase in migration of high-skilled women are many and not fully fleshed out by researchers, there is strong evidence that differences in women's rights between origin and destination countries are an important factor (Nejad and Young 2014).

In the United States, women represented 53% of high-skilled immigrants in 2017 and have outnumbered men since 2003.[8] Once in the United States, female high-skilled immigrants are distributed geographically in a similar manner to males, with New York being the most popular destination. Women also come to the United States from countries of origin similar to those of men, with a slightly higher rate of men from India. Nonetheless, female immigrants from India are three times more likely to be highly skilled than not, and women from high-income OECD countries are approximately twice as likely. In contrast, women migrants from Mexico are more than five times less likely to be highly skilled.

Large differences also exist. Turning to employment, only two-thirds of female high-skilled immigrants are employed, compared with more than 80% of males. Among top metro areas by population, female employment rates are highest in Boston and Washington, DC (73% in both), and lowest in Detroit and Riverside, California (60% in both). The differences are even

greater in STEM occupations, with more than twice as many men employed as women. Rates of self-employment are also lower for female high-skilled immigrants (3.5% of those employed full-time compared with 6% of males) but differ greatly by location, with the highest rates of self-employment found among high-skilled women in Miami. Unsurprisingly given the well-documented pay disparities by gender, a gender difference also arises in terms of wages of high-skilled immigrants. Among those employed and working full-time, men earn nearly $10 per hour more on average than women. Controlling for education level and country of origin, men still earn significantly more than women. Among the top earners of immigrants from India with a doctorate or professional degree, men earn an hourly wage of $74 whereas women earn $58.

   Female high-skilled immigrants also work in different occupations than males. Across metro areas, women are consistently more likely to work as managers and administrators, registered nurses, accountants and auditors, nursing aids, orderlies, and attendants. In contrast, men are generally employed as computer systems analysts, and computer scientists, managers and administrators, and truck, delivery, and tractor drivers. There are significant numbers of both male and female immigrants who are employed in occupations not commensurate with their experience level and the rates of underemployment are consistently higher for immigrants than for natives (OECD 2018).[9] Although specific occupations may be different, male and female high-skilled immigrants from the same country of origin and with the same level of education achieve similar levels of occupational prestige.[10]

I.   Why Do People Move? Pursuit of Opportunity

What motives people to leave their homeland and settle in a new country? Generally, it is the pursuit of opportunity. For refugees or lower-skilled migrants, this might mean the opportunity to raise a family away from a war zone or the opportunity to earn a living wage. For high-skilled migrants, migration has often unlocked opportunities for a better education and professional success. In both cases, once some migrants have gone abroad to a location, the odds go up that others will follow them and the links between their home and destination country are often strengthened (Freeman 2013).

   Many families choose to send their children to school abroad, in spite of the financial and emotional cost, with the hope that it will lead to a

superior education, a more valuable diploma, and better access to top labor markets. This force has become much stronger in emerging countries over recent decades as families acquire the means to invest more in their children. Other individuals may make the move abroad later in life, either for graduate school or job opportunities. Doctorate programs in the United States attract large numbers of international students, some coming from bachelor's programs in the United States or other advanced economies, but also many are at the beginning of their immigrant journey.

Although many who migrate for school ultimately settle permanently in the destination country, others may migrate on a more temporary basis. Temporary migration can lead to increased earnings, rapid career advancement, or an opportunity for individuals to prove themselves. Examples include children of prominent business families and top athletes in their prime. Additionally, migrants' first country may not be the same as their final destination. About 10% of recent immigrants to the United States either studied or worked in a third "transit" country before ultimately settling in America (Artuç and Özden 2016).

Individuals and families make heavy sacrifices to study and work in advanced economies, with the hopes that it will boost career prospects and earnings.[11] However, is it actually the case that immigration can have such a large impact on someone's life? And if so, is that improvement worth the family's investment? Looking at a simple wage comparison, the average wage in India is about $300 a month ($3,600 a year), whereas the average wage of an Indian programmer in California is more than 20 times higher at $75,000 a year. Although these numbers are interesting to consider, they fall short of answering the question, as a talented Indian would likely also have stronger wage opportunities back home.

A random experiment is nearly impossible to implement in this context, but the H-1B lottery system provides a unique quasi-experimental opportunity. (The H-1B program is described in greater detail later in this chapter.) H-1B visa applications open on April 1 of each year. The cap, currently 85,000, is consistently reached within the first few days. For example, more than 200,000 applications were submitted in 2019 within the first week, vastly outstripping supply. Given the deluge, the US Citizenship and Immigration Services (USCIS) collects visa applications for 1 full week and does not follow its usual first-come, first-served protocol. Instead, a lottery determines which applications are chosen to receive the visa.

Using data from a large Indian firm that relies heavily on the H-1B program to bring skilled workers to the United States, Clemens (2013)

determined that lottery selection was, in fact, random among the employees of this firm. Thus, controlling for personality traits and circumstances that may incentivize workers to migrate, those who won the visa gained an average $55,000 increase in annual earnings in comparison to those who did not. In the range of economic benefits, the opportunity gap found for these Indian programmers is a lower bound. One can easily imagine exceptionally high wages for superstar athletes or artificial intelligence researchers that would never have been available in their home countries.

High-skilled migration may be funneled primarily through education or work pathways, but those are far from the only ways. Some migrants simply follow the draw of an exciting global city such as New York, London, or Dubai that causes people to move around the globe. Family reunification represents the largest overall share of US admissions and is also becoming increasingly skilled in terms of admitted migrants.

In contrast to individuals leaving their homes willingly, the world is currently dealing with several major refugee crises (Dustmann et al. 2017). Although choices for refugee admissions principally fall under humanitarian aid, these populations can also affect talent distributions. Among the flight of German Jews from Nazi Germany, one can count Albert Einstein and Jon von Neumann as minds that revolutionized US science and innovation. A broader study looking at the field of chemistry found that in subfields with a refugee influx, innovation increased significantly more than those without it (Moser, Voena, and Waldinger 2014).

III.   The Race for Global Talent

The United States is currently the top destination for high-skilled migrants, but it is not clear that it will maintain this dominance into the future. While other countries are working hard to make themselves more attractive to foreign talent (Boeri et al. 2012), America is often doing the opposite through anti-immigrant rhetoric and inefficient policies. This chapter continues by focusing on some of the policy considerations.

Restrictions and limits on who can enter a country are an important responsibility of the government. Immigration policies, in part, are designed to protect citizens from external threats to health, job loss, cultural identity, and security. Complex debates emerge in which legislators must balance the desire of some citizens to maintain the status quo with the voice of those supporting greater dynamism. Historians point to many

moments when the United States chose to either open or close its doors to foreign workers to either the profit or detriment of the economy. In 2019, the United States is increasingly divided on what the future of US immigration policy should look like.

As a country, the United States admits more immigrants than any other country. In 2017, net migration to the United States was estimated at 4.5 million people over a 5-year period, significantly more than the net inflow into any other individual country (World Bank Open Data 2019a, 2019b). The relative rate of immigrants per capita in the United States is about 14.4%, which is similar to or larger than most other OECD countries (World Bank Open Data 2019a, 2019b).

In regard to those who are admitted, the highest quantity of immigrants to America comes through family-based immigration. Of the approximately 1 million "green cards" (permanent residency cards) granted each year, only 140,000 are allocated for employment-based immigration, whereas the majority are given to immediate family members (e.g., spouses, parents, children) or extended family of US citizens or lawful permanent residents. There is no annual cap on immediate family immigration. A small portion of immigrant visas are also issued for other reasons, such as refugee or humanitarian purposes. The strong emphasis on family-based migration historically has tilted US admission toward lower-skilled groups. Hunt (2011) provides a detailed review of visa categories and characteristics.

The world's most talented individuals rarely struggle to migrate wherever they choose. In the United States, the temporary O1 visa, the "superstar visa," admits those with demonstrated extraordinary abilities. The USCIS provides no explicit requirements beyond the possession and previous recognition of extraordinary abilities and does not set an annual cap on the number of visas that can be awarded. In 2000, approximately 6,500 individuals were admitted, but that number has risen to 8,500 in 2010 and more than 17,000 in 2017 (US Department of State 2019).

Those willing to invest large sums of money have also been welcomed into the United States. The EB-5 (employment-based fifth preference) visa, often called the "millionaire's visa," is available to those willing to invest at least $1 million in a US business that will create or preserve at least 10 full-time jobs. If the foreign entrepreneur chooses to invest in a rural or high-unemployment region, the investment threshold is reduced to $500,000. This visa entitles the investor and immediate family to obtain lawful permanent residency status. The number of EB-5 visas issued has increased dramatically in recent years, from only 346 in 2004

to nearly 10,000 in 2016. Of these, more than 70% are awarded to wealthy Chinese nationals. A 2010 report found that real estate was the most common industry, with nearly $70 million invested between 1992 and 2007 (ICF International 2010).

The majority of skilled immigrants do not, however, enter the United States through the elite visa programs. Most skilled immigrants are simply those with above-average talent and sufficient education, often coming straight from schools and early in their careers. Colleges and universities play a key role in shaping immigration through their selection of individuals for the F1 (student) or J1 (exchange visitor) visas. Inclusive of renewals, 393,573 F1 visas were issued in fiscal year 2017. An F1 visa does not offer students long-term employment or a direct path to citizenship, but it can offer a path to an H-1B visa or other school-to-work transitions.[12] In 2017, about half of all H-1B petitions for initial employment were filed on behalf of immigrants already in the United States and 34,488 H-1B visas were allocated to individuals transitioning directly from an F1 visa (USCIS 2018a, 2018b).

Regardless of whether individuals come through a US school or directly from abroad, skilled migrants almost always encounter the employer-driven nature of America's system. Compared with countries that use a points-based system to select migrants, a job offer is the critical step to a work visa in an employer-driven system. Examples of countries with an employer-based system include Japan, Korea, Sweden, Norway, and the United States. In the United States, this brings us back to the H-1B visa program.

A. H-1B Visa Program

The H-1B program was established by the Immigration Act of 1990 and allows for temporary employment of workers in specialty occupations. Applicants must hold at least a bachelor's degree or comparable qualification. Examples of occupations frequently filled by H-1B holders include computer programming, accounting, engineering, theology, consulting, and medicine. Figures 2*a* and 2*b* describe traits of H-1B recipients in 2017. The rationale behind offering this type of visa is to satisfy a pressing need for specialty workers who cannot be found in the native population without lengthy and difficult worker retraining programs (Kerr 2019).

The H-1B visa is valid for 3 years and is renewable once. Although the expectation at the time of application is that the worker will leave the
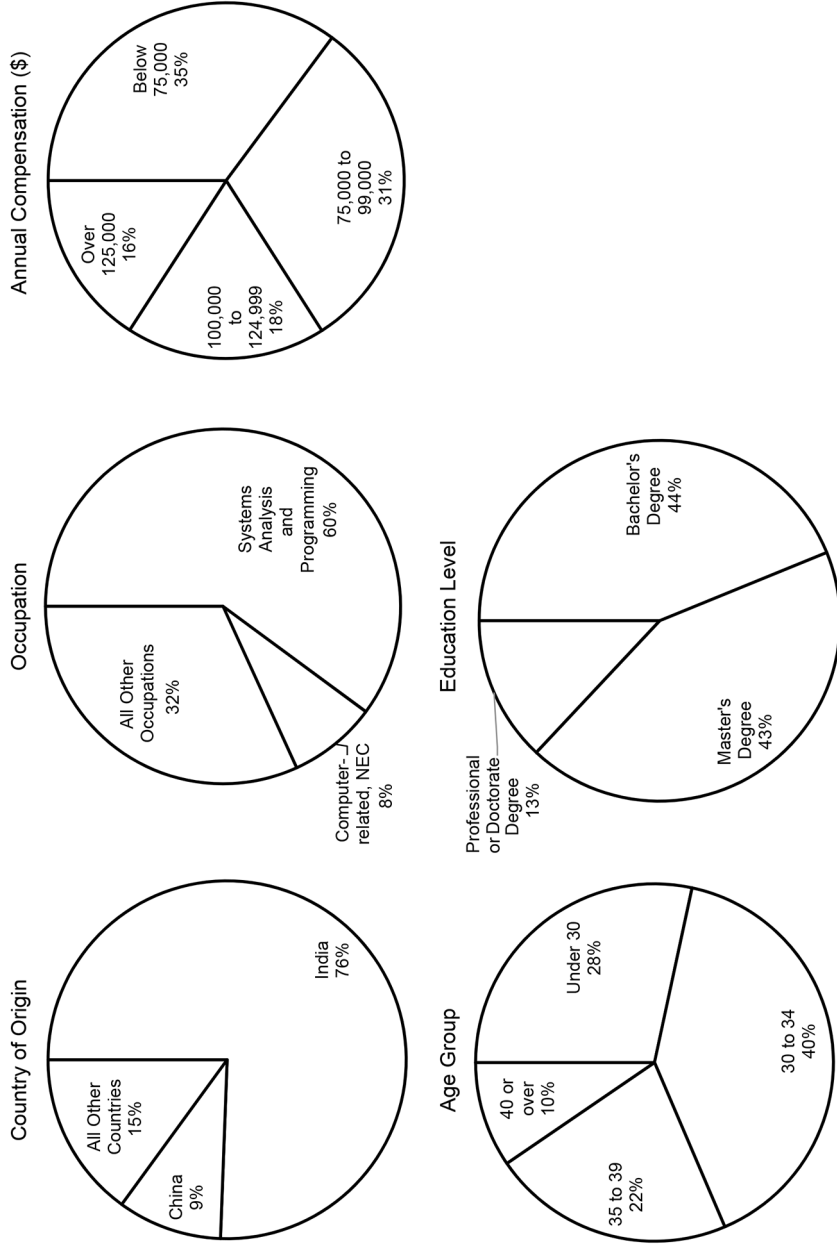
Fig. 2a. Characteristics of H-1B beneficiaries in FY 2017.
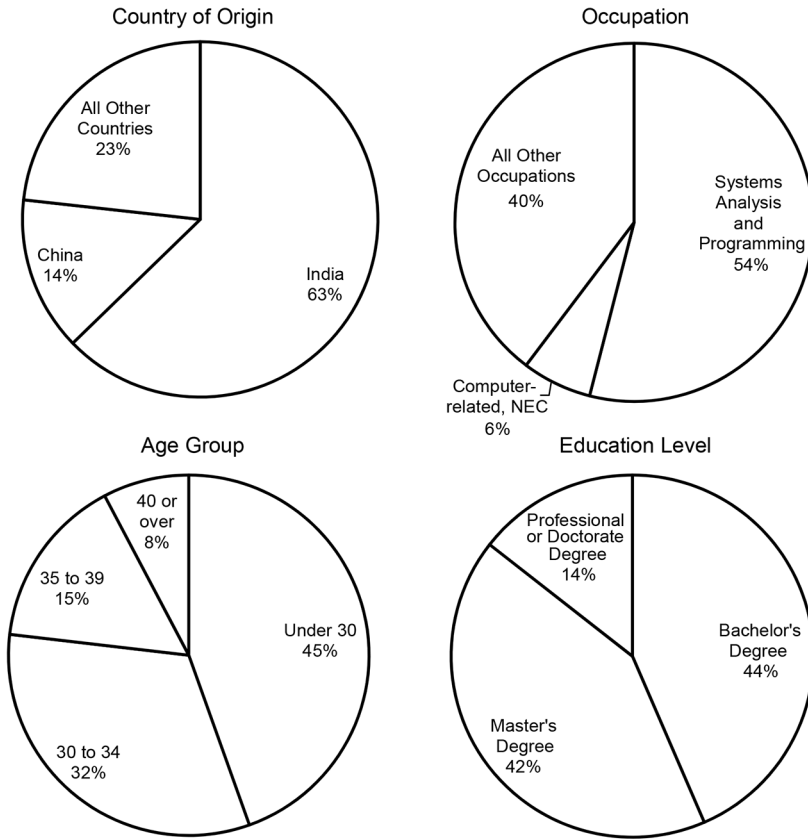Source: Data from USCIS (2018).

Fig. 2b. Characteristics of H-1B petitions for initial employment in FY 2017.
Source: Data from USCIS (2018).

United States following the expiration of the visa, the H-1B also has a "dual-intent" feature. This allows the sponsoring firm to petition for a green card on behalf of the worker, eventually securing the worker lawful permanent residence. For a firm with 26 or more full-time employees in 2008, each application costs the firm $2,320 (Kerr et al. 2015a). Hiring a foreign worker has additional costs for the firm beyond those generally associated with hiring a new worker (e.g., interviews, training, legal fees). In 2019, the fee ranges between $1,600 and $7,400 depending on employer size, immigrant worker share, and premium processing.

Unlike the O1 visa, the H-1B is subject to an annual cap. When the visa was first introduced in the 1990s, the cap of 65,000 exceeded employer demand. However, applications increased during the internet tech boom and Y2K bug IT transition, and the cap was raised to accommodate demand. It was first increased to 115,000 and then again to 195,000. Demand

for H-1B workers lagged during the recession of the early 2000s, and the cap expansion was not renewed in 2004, returning the cap to the original 65,000. Later legislation added 20,000 further visas designated specifically for applicants with postgraduate degrees from American institutions. Combined, there is an annual cap of 85,000, which is still in place today, as shown in figure 3.

This cap, however, only applies to applications for initial employment by cap-subject firms. The cap does not apply to petitions to extend an individual's period of stay, change the conditions of employment, or request of new employment for an H-1B worker already in the United States. Also exempt from the cap are individuals approved for initial employment if the employer is an institution of higher education, a qualified nonprofit, or a governmental research organization. In 2017, there were 179,049 H-1B visas issued, including renewals. In all recent years, demand of cap-subject firms has overwhelmingly exceeded visa supply. US business leaders consistently argue for an expansion of the program, but Congress has yet to pass reforms.[13]

Figure 4 reports the number of H-1B petitions approved by year and application type. Petitions for initial employment are divided into those filed on behalf of individuals outside of the United States and individuals already located in the United States. The second group generally includes individuals graduating from US academic institutions. Petitions for continuing employment, however, include all petitions relating to individuals who have previously received an H-1B and are requesting an extension, a change in employment conditions, or a request for new employment. The effect of economic recessions on H-1B petitions is clear
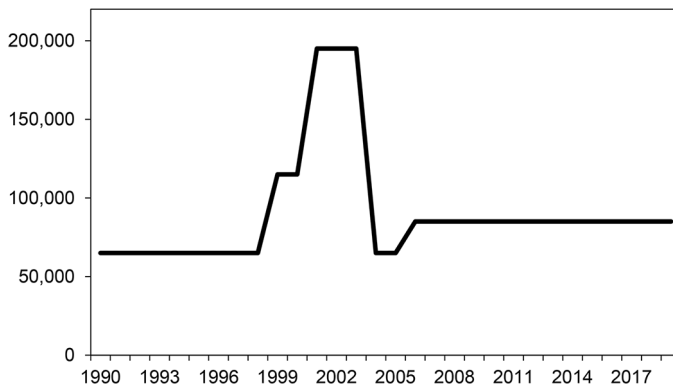

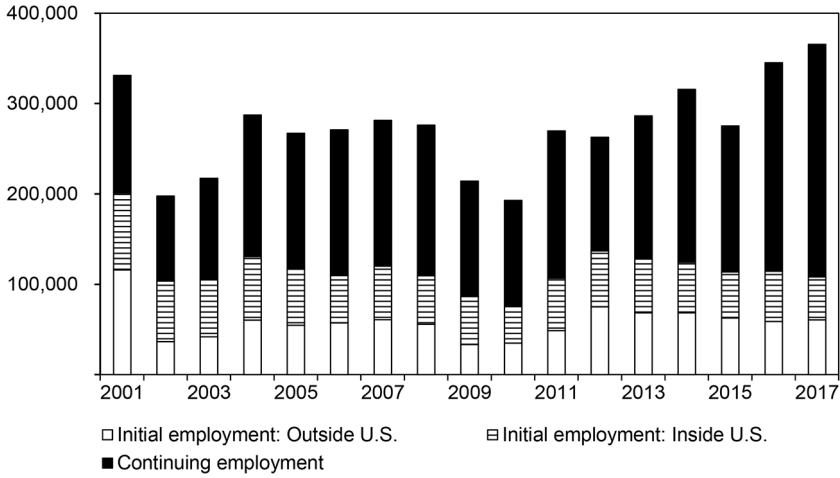**Fig. 3.** Evolution of H-1B visa cap for new visa issuances

Fig. 4. H-1B visa approvals.
Source: Data from USCIS (2018).

in both fiscal years 2002–3 and 2009–10. In addition, there is a marked uptick in petitions for continuing employment in recent years.

Employers are required to pay H-1B visa holders the "prevailing wage" based on the worker's position, experience, and qualifications. This is determined by taking the higher of what the firm pays or the established wage rate in the area. In 2016, the mean salary for H-1B visa holders was $80,000, but there is a broad range from lower-skilled employees of outsourcing firms earning $60,000 to higher-skilled workers earning greater than $150,000 (Ruiz and Krogstad 2017).

A vast majority of visas in recent years have been awarded for computer-related occupations (Kerr et al. 2015a). In 2017, immigrants from India accounted for 72% of H-1B visas and immigrants from China were awarded another 13%, for a combined 85%. This is a stark increase from a combined 50% that was present in the early 2000s (US Department of State 2019). The design of the H-1B program places the power in the hands of the firms to decide what workers they need, as opposed to relying on legislative mandates. This makes the system more responsive to current market needs.

Another widely used but lesser known employer-based visa is the L1. Available for the temporary migration of employees within a multinational firm, there were 78,178 L1 visas (including renewals) issued in 2017. Only employees who have been employed by the firm for at least

1 of the previous 3 years are eligible, and the visa has a maximum stay of 7 years. Similar to the H-1B, the L1 is a "dual-intent" visa, whereby it provides a path to a green card. Yeaple (2018) provides additional discussion of the L1 visa.

The TN visa was created under NAFTA and applies specifically to Canadian and Mexican citizens. As of 2019, the TN visa is expected to continue in the post-NAFTA era. Similar to the H-1B, workers must have a job offer prior to applying for the visa and are restricted to skilled occupations. In 2017, 16,119 TN visas (including renewals) were issued, with the vast majority going to Mexican citizens.

Other countries use different approaches for determining the migration of skilled individuals. The European Union, for example, has open borders between member states. Others, such as Canada, Australia, and the United Kingdom, have traditionally utilized a points-based system that admits new immigrants based on individual characteristics such as age, education, and work experience. Many countries have also introduced specialized visas for classes of workers, perhaps most prominently "start-up visas" in an effort to attract immigrant entrepreneurs. A discussion of these alternative policies is beyond the scope of this chapter, which continues to focus on the US case.

B.   What Does an Employer-Based System Mean for the United States?

The use of an employer-based visa system has major implications for the United States. Some important advantages include a job guarantee and the potential for better immigrant selection. First, the employer-based system avoids situations in which an immigrant is unemployed upon arrival by making a job offer the essential piece of the application. In addition, although a points-based system can rank individuals based on education level or language skills, employers often value skills that are difficult to measure. These can be hard skills (e.g., knowledge of an important computer language) or soft skills (e.g., creativity, teamwork).

The H-1B program is also remarkably flexible and thus able to respond quickly to market demands. As there are no restrictions on how many visas can go to each industry or to immigrants from a specific country, employers recruit the exact foreign workers they desire. Not surprisingly, the composition of the program fluctuates over time. The share of visas going to workers from India was only 20% in 1995, but it more than doubled to 45% just three years later, before dropping back to 28% in 2002. It has recently exploded to over 70% today. Comparatively, the share of

visas for computer-related occupations was 25% in 1995, 57% in 1998, 28% in 2002, and over 70% in 2012 (Kerr et al. 2015a).

One potential concern related to the flexibility of the system is that it may be harmful to foreign workers and younger native workers. Workers may be brought to America based more on short-term opportunities rather than long-term needs and, thus, be dislocated in the event of recessions or industry-level shifts. In addition, if students choose a college major based on current labor market demands, they may find that, upon graduation, many of those jobs have been filled by H-1B workers.

The employer-based system also presents some unique concerns for the relationship between the firm and the worker. H-1B employees are legally tied to their sponsoring firm. The motivation for this is to incentivize firms to pursue and invest in the training of foreign workers. One can imagine a situation in which workers were completely free to move between firms resulting in an underinvestment in the recruitment of foreign workers because of some firms investing time and money in employees only to see them quickly poached by another firm. The original firm loses time and money in addition to talent.[14]

Although tying workers to the sponsoring firm has benefits for the firm, it is not clear whether that is the case for workers. Being legally tied to a firm severely weakens an employee's negotiating position. This may expose workers to the firm demanding they work long hours, the firm not offering them earned wage increases, or the firm purposefully classifying visa holders under an occupation that is below their true ability or jobs tasks to avoid paying a higher wage.[15] The legal ties of a worker to the sponsoring firm are even stronger when the firm is additionally sponsoring the worker for a green card, a process that can take 7–12 years. Hunt (2017) found that worker mobility is reduced by 20% while waiting for green card processing.[16]

More broadly, a discussion of the strengths and weaknesses of the H-1B program depends heavily on one's perspective regarding the role of firms in policy. Although a points-based system operates in a very transparent manner with formulas published on country websites and open to debate, an employment-based system overwhelmingly relies on private decisions by large firms such as Microsoft or Google. If one is concerned about the powerful voices of firms potentially overpowering the thoughts of others involved in the immigration debate (e.g., native workers, policy makers), a potential solution is to increase expectations of transparency among firms hiring immigrant workers.

Moreover, many H-1B visas are used today by foreign firms to facilitate outsourcing and offshoring work, with some US commitments to this end even being made as part of 1995 World Trade Organization agreements on international trade in services.[17] This less-intended use of the visa by firms such as Infosys and Wipro has recently accounted for a substantial share of visas. Outsourcing companies tend to use the visa program to bring their overseas workers to America for a short period of time with the purpose of learning the US-based systems and interfacing with US-based clients before returning abroad to company work (Hira 2010; Park 2015). On average, H-1B workers at outsourcing companies receive much lower pay and assimilate less well than other visa holders. Ruiz and Krogstad (2017) found that average salaries for H-1B holders at outsourcing companies were between $75,000 and $80,000, compared with roughly $140,000 for H-1B workers at Apple and Facebook. These two distinct uses of the H-1B visa program have led to two very different classes of skilled foreign workers.

The increasing use of the H-1B program by outsourcing companies not only influences the average wage and the assimilation of foreign workers, but it also affects who ultimately receives the limited number of visas. Traditionally, firms hiring a high-skilled foreign worker through the H-1B process will have invested time and money into finding the best fit for the position and, thus, may only submit one application. Outsourcing companies, however, are often less concerned about a specific individual being selected in the lottery and are likely to submit many applications for their needs (Harnett 2017). Consequently, hard-to-find, high-skilled applicants are at a disadvantage to those with more average skills.

Given that there are no caps on the number of workers a firm can sponsor, there is a clear imbalance in regard to which firms hire the majority of H-1B visa holders. In 2016, 59,184 H-1B petitions were filed by the top five employers, all of which outsource. Cognizant Tech Solutions, a firm based in New Jersey but with significant operations in India, filed 21,459 petitions. Cognizant has been the leading H-1B sponsor since the USCIS began publishing the data in 2012. Microsoft was the top non-outsourcing firm in 2016 and ranked sixth overall with 3,556 petitions filed. Figure 5 presents a ranking of the top H-1B visa sponsors in fiscal year 2016 with an indicator of whether the firm outsources.

Figure 6 expands the previous figure to plot the average annual salary and the percentage of H-1B workers with a master's degree for top hiring firms. The size of the bubbles corresponds to the number of visas sponsored by the firm. There are distinct clusters in the data and also a concentration of large circles in the bottom left corner.
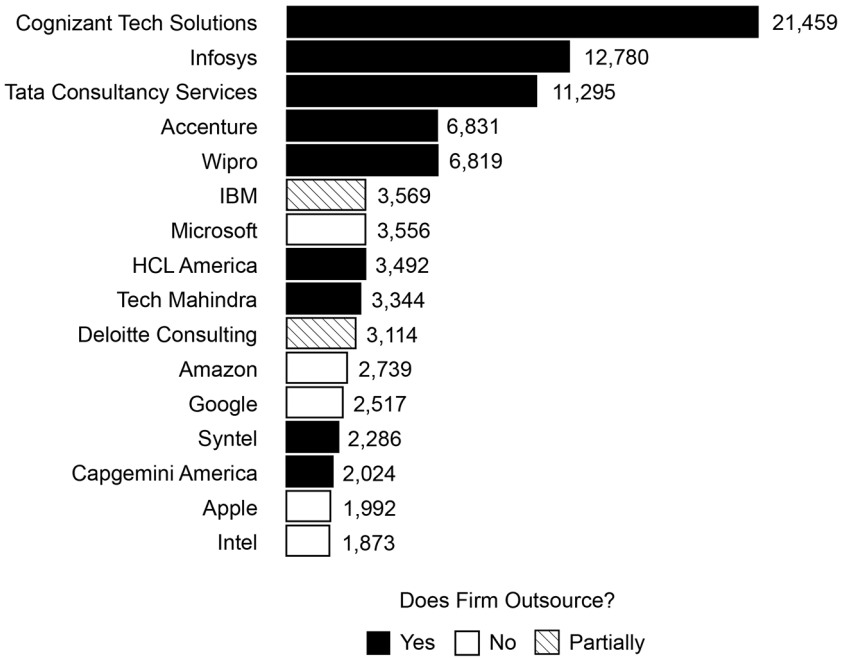
Fig. 5.   Top H-1B Sponsors in FY 2016

At the time of writing, there are emerging data that outsourcing companies have been receiving substantially fewer H-1B visas since 2018, with allocation rebalancing toward traditional US tech companies. Time will tell if this shift is permanent and how it plays out across other visa classes like the L visa.

Because of the low supply of H-1B visas, many high-skilled workers and firms are turning more frequently to the Optional Practical Training (OPT) program (Bound et al. 2015). The OPT program allows for the employment of individuals on an F1 (student) visa in an area that is directly related to the student's major area of study. Eligible students can receive up to 12 months of OPT employment authorization to use either before or after the completion of their studies. As of 2008, students who received their degree in a STEM field are eligible for a 24-month extension for a total of 3 years. There is no cap on the number of OPT authorizations that can be issued each year. Students must be recommended for OPT by their academic institution and a job offer is not required. Workers on OPT do not get a new visa but rather maintain their F1 status until they either transfer to another visa through employment- or family-based routes or return to their home country.
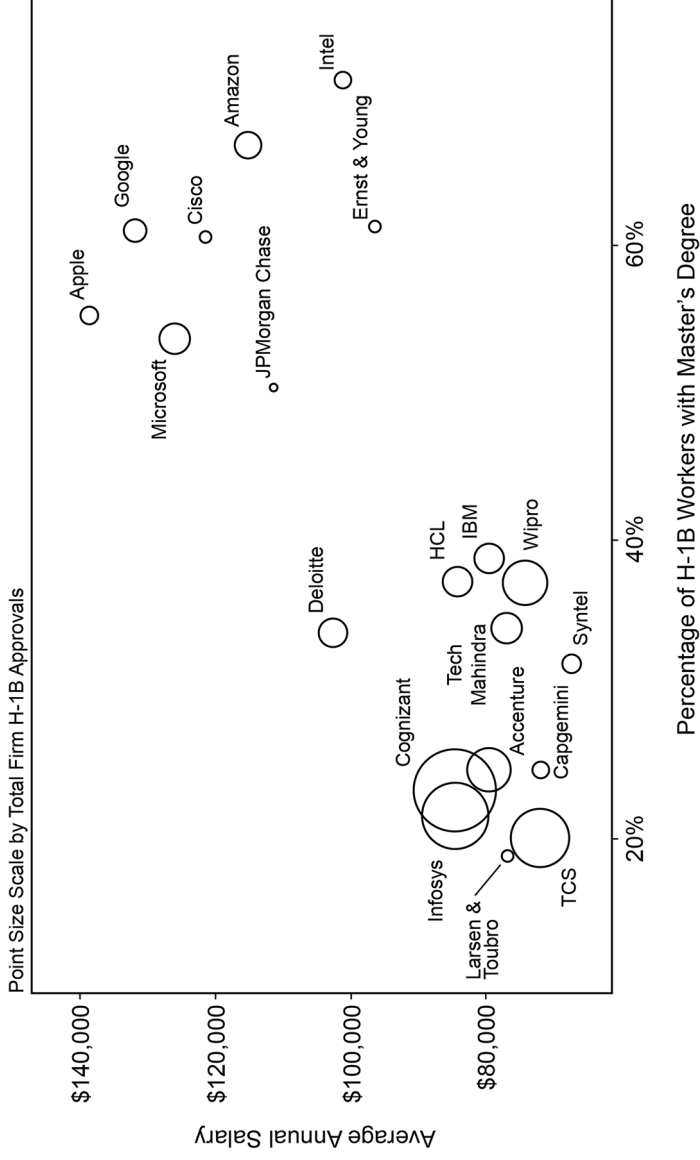
Fig. 6. Top 20 H-1B Sponsors in FY 2016 – Average Salary and Degree Attainment

The Institute of International Education collects data, including use of OPT, through a survey of more than 3,000 accredited US higher education institutions. These data show that OPT use has been growing rapidly over the past decades, from 21,058 individuals in 2000–2001 to 203,462 in 2017–18 (Institute of International Education, Inc. 2018). A recent Pew report (Ruiz and Budiman 2018) estimates that 53% of those approved specialized in STEM fields and much of the growth in OPT use has come from STEM graduates (400% growth since 2008). The country of origin composition for OPT workers is very similar to that of H-1B visa holders, with 57% of all participants born in India, China, or South Korea.

The use of the OPT program as a substitute for the H-1B is not an optimal solution. In the context of the visas and school-to-work transitions, many immigrants who moved to the United States to study hope to stay and begin working following graduation. Given the uncertainty surrounding access to the H-1B visa and low lottery probabilities, there is no longer a reliable pathway from school to work. OPT, even with the STEM extension, provides only a short-term stopgap before unlucky applicants need to reenter school or leave the country. Although the OPT program rests with individuals and their academic institutions, some reports suggest abuse by employers that take advantage of vulnerable foreign students.[18]

C.   Why Do Firms Choose to Hire H-1B Workers?

One of the main debates regarding the H-1B program (beyond its use by outsourcing companies) is how an inflow of foreign workers affects the native workforce. Proponents of the program, such as Bill Gates of Microsoft, claim that firms create new jobs when they hire H-1B workers.[19] Critics, however, suggest that firms use cheaper H-1B workers to substitute for more expensive native workers. The US economy, characterized by both giant corporations and fast-growing start-ups, is impossible to characterize with one generic answer and judgment calls exist. For example, reasonable advocates could disagree about how long firms should be expected to wait for worker retraining before hiring foreign talent. Given a complex system, it is still worthwhile to discuss patterns that have emerged.

As noted earlier, the raw data almost always show a positive correlation between H-1B visas and increased employment of native workers—if for no other reason than successful firms tend to grow their worker bases across all types of employees.[20] To identify a causal relationship, two

econometric approaches have been used. The first approach utilizes the Longitudinal Employer-Household Dynamics (LEHD) database. The LEHD includes individual-level employment profiles for every worker and firm in the United States and includes information on immigrant status, making it a rich data set for answering questions regarding high-skilled employment. Kerr, Kerr, and Lincoln (2015b) use the LEHD to consider how the large changes in the H-1B cap affected firms by comparing firms that were sensitive to the changes with those that were less sensitive.[21] The researchers found that the hiring of young, skilled immigrants corresponded to increased employment of skilled natives in the company, supporting a growth narrative.

The second method takes advantage of the 2006 and 2007 H-1B visa lottery, in which the supply of visas lasted longer than the first week but not for the full year. In this case, a mini-lottery was used to allocate visas among the applications received on the final day. Doran, Gelber, and Isen (2017) compared firms whose applications won and lost the lottery on the last day, providing a small, randomized sample. In contrast to the optimistic view described earlier, the researchers found that firms that won the lottery tended to reduce employment of native workers in subsequent years. This result favors the cost-minimization narrative, though employer behavior in these slower years may not be comparable to decisions in a typical oversubscribed year. Both of the previously stated approaches have merits and shortcomings, and the relationship between H-1B and native workers is not yet resolved.

A clearer relationship may be revealed by reframing the question. Previously, it is assumed that all workers are equal and that firms pursing H-1 workers for cost-saving reasons would be replacing a young native worker with a young immigrant worker. However, this may not be the case. A number of important critics of the program claim that firms use H-1B visas to keep their workforces younger (Matloff 2003).

If firms were truly substituting young native workers with young immigrant workers, it is unlikely there would be a significant opportunity to save costs. Studies have found that the difference in wages between otherwise similar immigrants and natives is 5% or less (Kerr 2016). Given the requirement to pay market wage and the additional costs incurred in the visa application process, it is likely that hiring an immigrant may be even more expensive than hiring a native worker. However, if instead, the firm is replacing an experienced and older native worker with a young immigrant worker, the picture may look different and cost savings could be significant. Assuming 2% annual wage growth over 30 years, a worker with a starting salary of $80,000 would now be making about $145,000.

Now, hiring a new worker at the starting salary of $80,000 saves the firm substantial money, even after application and legal fees. Even though age discrimination is illegal and firms cannot fire a worker simply for being old, firms can argue for termination on the grounds of wages being too high for the business to support or an obsolete skill set.

Building on the theoretical case presented earlier, real-world data provide some support. One case in which layoffs of older workers were noticed by the public was the 2016 Intel layoffs, during which those over the age of 40 were more than twice as likely to be laid off (Rogoway 2016). The LEHD data also support an age differential. Job growth is asymmetric across age groups. Young skilled natives benefit from increased employment of young skilled immigrants, but the employment of older US workers stays flat (Kerr et al. 2015b). This finding supports the argument that older Americans can be disadvantaged by an increased reliance on immigrant workers.

The replacement of older workers is also disproportionately affecting some occupations and industries more than others. The most prominent example is computer programmers in the tech industry. This occupation is especially vulnerable to age-based displacement by H-1B hires because substitutability is high. In essence, work experience is less important in STEM-related work because of the rapidly changing nature of the work. Compared with managers, doctors, and lawyers, where job experience is especially important for success and accumulates over time, substitutability of computer programmers is four times higher (Kerr et al. 2015b). Other science and engineering disciplines also display high substitution capability. Paired with a lack of protective barriers such as unions and occupational licensing, STEM jobs provide a soft point for firms seeking to cut costs though the hiring of high-skilled immigrants (who have often trained in these same fields).

High-skilled natives are somewhat adjusting via occupational choice. While immigrants flood technical fields that require strong quantitative and analytical skills, native workers are shifting to complementary occupations that rely more on communication skills (Peri and Sparber 2011). This is often connected to a boost in earnings potential.[22] Therefore, although firms are hiring an increasing number of both immigrants and natives, they are not hiring them for the same job.

Several reforms could make the H-1B visa program more efficient and selective (Kerr 2019), tilting visa usage toward growth initiatives versus cost minimization and outsourcing. The average quality of H-1B recipients would likely rise if visas were allocated based on wage-ranking schemes, potentially with occupational and regional maximums, instead

of a lottery. Although wages do not perfectly capture a worker's contribution to society, they do take advantage of labor market signals. Adding occupational and regional maximums along with wage rankings would ensure that workers are not exclusively located in wealthy coastal cities or working in exclusively STEM occupations. The visa allocation system could further move from a yearly filing system to a quarterly one, in which a quarter of the total visa cap is allocated every 3 months. This change would shorten waiting periods and allow for a more continuous inflow of foreign workers. Other potential changes to the program include establishing a robust H-1B minimum wage and indexing admissions to economic conditions. These solutions are imperfect, as further discussed in *The Gift of Global Talent: How Migration Shapes Business, Economy and Society* (Kerr 2019) but help solve some glaring issues and are arguably politically feasible.

IV.   Where Do We See the Largest Impact
of High-Skilled Immigration?

One of the sectors most impacted by high-skilled immigration in the United States is science and technology. Jones (2002) estimates that half of US productivity growth in recent decades can be attributed to increased employment in STEM fields, much of which is because of immigration. Although immigrant workers account for a substantial share of the college-educated workforce (17%), they are nearly twice as prevalent in STEM occupations (29%) (Hanson and Liu 2018; Ruggles et al. 2019). In terms of inventors, non-US citizens account for approximately a quarter of all patents (WIPO, 2019). High-skilled immigrants are clearly an essential piece of American innovation.

The US Patent and Trademark Office (USPTO) has provided patenting records for US patents since 1975, longer than the WIPO. Although the USPTO does not collect data on the immigration status of the inventors, an ethnic naming convention developed by Kerr (2007) identifies the probable ethnicity for more than 99% of inventors. In 1975, Anglo-Saxon and European names accounted for an overwhelming majority (91%) of US-based patents. By 2015, however, this share had declined to 72%. Much of this decline is because of a rise in inventors from China and India, as shown in figure 7. In 2015, Chinese inventors accounted for 10.4% of patents and Indian inventors claimed 7.3%. This is an extraordinary increase from each groups' starting point at about 1.5% in 1975.

This rise in innovative output is driven by a rise in immigrant participation in STEM fields. In 1960, only 6.6% of STEM workers were immigrants,
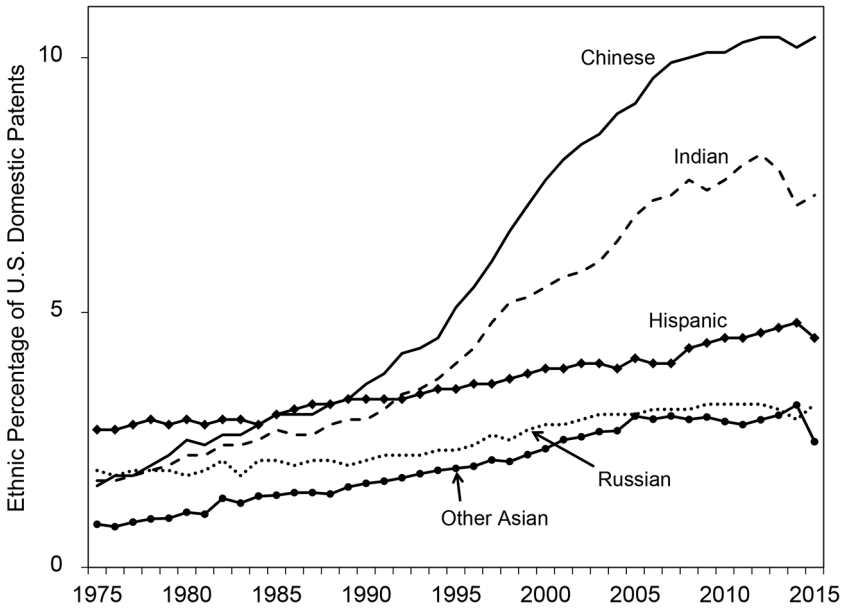
Fig. 7. Trends in U.S. ethnic patenting. Series uses ethnic naming conventions applied to inventors based in the United States.

Source: Data from U.S. Patent and Trademark Office.

but that share has risen to almost 30% today. Innovative STEM workers are one of the main drivers of innovation in the United States, especially in terms of developing advanced technologies. When considering all inventors not of Anglo-Saxon or European ethnic descent, nearly 40% of patents in the computers and communication sector were developed by "ethnic inventors." Figure 8 shows how pervasive these rising immigrant shares are across technology fields.

Beyond changes to the H-1B program, many comment on the need to build a visa program targeting immigrant entrepreneurs. Although the entrepreneurial tendency of immigrants is supported by academic research (Hunt 2011; Fairlie and Lofstrom 2014; Kerr 2019), the reasons are less clear. Some explanations cite personality traits, arguing that immigration selects individuals with a higher tolerance for risk, whereas others reference cultural differences and the support immigrant entrepreneurs often receive from tight-knit ethnic communities. Other explanations, by contrast, suggest that immigrants enter entrepreneurship more out of necessity than choice, because of poor opportunities in regular employment in their new home countries.

Although immigrant entrepreneurs are often celebrated, there is not a clear pathway for the founders of high-growth and job-creating firms to
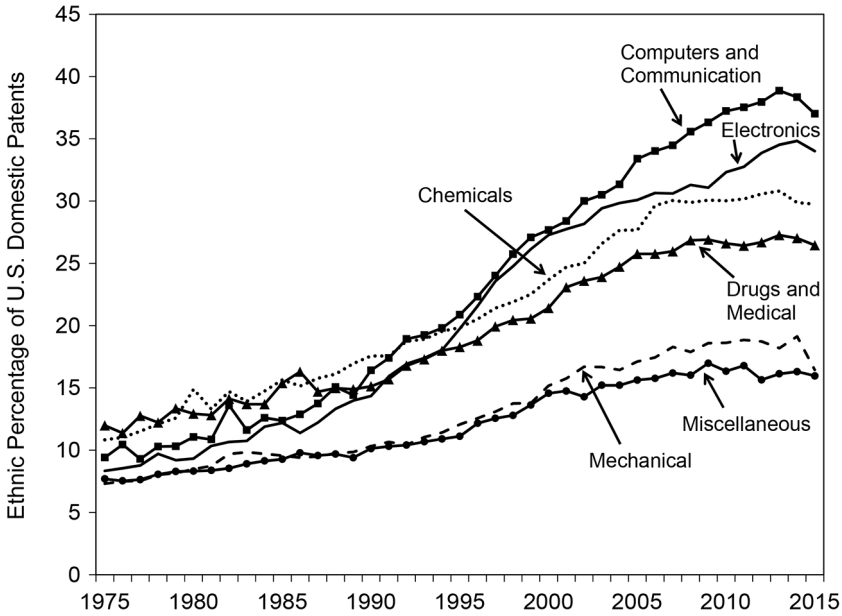
Fig. 8. Trends in U.S. ethnic patenting by technology sector. Series show the share of a sector's inventors who do not have Anglo-Saxon or European ethnic names.
Source: Data from U.S. Patent and Trademark Office.

locate in the United States. The proposed Startup Visa Act would have created a visa category specifically for foreign entrepreneurs who had raised capital from American investors but, although the bill had bipartisan support in Congress, it was never signed into law. Despite this difficult visa environment, Kerr and Kerr (2017) estimate that the immigrant share of entrepreneurs increased 10% between 1995 and 2008 (from 17% to 27%).

Changes to US high-skilled immigration policy have wide-reaching effects beyond simply the workers and firms directly involved. Immigration is rarely immediately Pareto improving, and someone is often made at least a bit worse off in the short run when inflows increase. Soon, however, the economy adjusts and grows, and in the long run US history speaks to the power of immigration to create new jobs and opportunities. Policy makers weigh these substantial economy-wide gains against the potential losses for some existing US workers. These policy calibrations will become more important for the economy and society in the decades ahead.

V.   Conclusion

This chapter presents data and considerations on the migration of high-skilled individuals. In moving forward on policies related to high-skilled immigrant workers, one must balance the goals of the country. Expanding visa programs for high-skilled workers and talented foreign students is a strong lever for boosting innovation and growth, and its importance will increase as domestic population growth stagnates. However, there are abuses to the system and some workers, especially older tech workers, suffer diminished career prospects in the presence of inflows of foreign workers. *The Gift of Global Talent: How Migration Shapes Business, Economy and Society* (Kerr 2019) explores these and other questions in greater detail.

To better understand the patterns of high-skilled immigration, we must support increased access to rich data sets. Kerr et al. (2015a) discuss the value to be gained from linking existing data across government entities. Multinational firms are the leading employers of high-skilled migrants, and it is important to understand these firms from a global perspective. In addition, linking visa and census data would be incredibly valuable in answering current and future research questions. Expanding our knowledge base in regard to high-skilled migrants will, in turn, lead to better policy discussions and decisions.

Looking forward, high-skilled immigration will continue to be an essential piece of US immigration policy. High-skilled workers and the firms that employ them will continue to push for increased access to employment-based visa pathways. Although communication technologies like video conferencing and digital labor platforms are connecting us globally, thus far these new technologies have reinforced the power of place. And ultimately with the knowledge economy, people are what make the place.

Endnotes

1. In an August 2017 poll, 42% of respondents said the United States admitted too many "low-skilled workers," versus 12% saying too few. By contrast, 36% of respondents felt the United States admitted too few "high-skilled workers," versus 15% saying too many. At

both skill levels, about half of respondents thought the level was about right or had no opinion. Politico & Morning Consult, "National Tracking Poll #170803 February 03–06, 2017: Cross Tabulation Results," August 2017. https://www.politico.com/f/?id=0000015d -c4ae-d494-a77f-e6be72bd0000 (Kerr 2019).

2. Even beyond the Nobel Prize, immigrants account for disproportionate share of top scientific awards or measures of extreme impact. See Stephan and Levin (2001).

3. Data for Nobel prizes are derived from AggData at https://www.aggdata.com /awards/nobel_prize_winners, supplemented with data from the Nobel Prize website for the years 2011–2015.

4. See also Miguelez and Fink (2013) and Beine, Docquier, and Rapoport (2007).

5. Related work includes Carlino and Kerr (2015), Kerr et al. (2017), and Kahn and MacGarvie (2016).

6. For related literature, see Borjas and Doran (2012, 2015a, 2015b).

7. The growth in foreign students is primarily because of emerging nations producing ever-larger total numbers of students, with China catching up from the suppression under Mao that ended in the late 1970s (Bound, Turner, and Walsh 2009). India also lifted in 1996 its earlier $500 cap on foreign exchange that its citizens could take from the country, which had previously limited students and tourism.

8. All statistics calculated using the American Consumer Survey (ACS) data down-loaded from (Ruggles et al. 2019). High-skilled immigrants are defined as having at least 1 year of tertiary education and a country of birth outside of the United States.

9. The OECD reports that 37% of high-skilled females in the United States were under-employed in 2010 (Kerr et al. 2016).

10. Calculation is based on the ACS occupational standing variable, which assigns a Nakao-Treas prestige score to each occupation. https://usa.ipums.org/usa-action/variables /PRENT#description_section.

11. International students generally pay full tuition as a way to help universities cover expenses. For related literature, see Bound et al. (2016) and Shih (2017).

12. Related work includes Kato and Sparber (2013).

13. For example, Bill Gates of Microsoft testified before Congress in 2007 to argue for an expansion of the program. Mark Zuckerberg and Marc Cuban have also been vocal on the subject.

14. An example of a market where this is a serious problem is that of senior business executives. See Terviö (2009) for a discussion.

15. YouTube video of lawyers describing working around system: https://www.youtube .com/watch?v=vuY9Krvmv8I.

16. See also Depew, Norlander, and Sorensen (2017).

17. Lawyers debate the World Trade Organization (WTO) agreements and their impli-cations. India has filed a complaint with the WTO over changes made to H-1B visa fees that disproportionately affected Indian firms (Kerr 2019).

18. For example, see Swaminathan (2017).

19. Gates testified before the US Senate Committee on Health, Education, Labor, and Pensions in 2007 that Microsoft hired four employees to support each H-1B worker.

20. See also Bound, Khanna, and Morales (2017) and Peri, Shih, and Sparber (2015).

21. See also Ghosh and Mayda (2017) and Mayda et al. (2017).

22. Income is not the only factor high-skilled individuals consider when selecting a ca-reer, making strict salary-based arguments incomplete. For example, see Stern (2004).

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