



# The Accelerating Decline in America's High-Skilled Workforce: Implications for Immigration Policy

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by Jacob Funk Kirkegaard

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Kirkegaard explores the increasingly dysfunctional state of present US high-skilled immigration laws and recommends a coherent set of immediate reforms, which should aim to facilitate continuously high and increasingly economically necessary levels of high-skilled immigration to the United States. In recent decades American skill levels have stagnated and struggled to make the global top 10. As baby boomers retire, the United States risks losing these skills altogether. In response, the United States should address high-skilled immigration in its broader foreign economic policies in an attempt to remain a global leader in the face of accelerating global economic integration.

## The Accelerating Decline in America's High-Skilled Workforce: Implications for Immigration Policy

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America rose to economic prominence on the shoulders of the most highly skilled workforce in the world. However, during the last 30 years, skill levels in the US workforce have stagnated. Americans aged 25–34 today do not possess higher skills than do their baby boomer parents. So when American baby boomers retire, they will take as many skills with them as their children will bring into the US workforce. While their parents may have been “the brightest kids on the global trading block” when they entered the workforce, Americans entering the workforce today barely make the global top ten. America is no longer a skill-abundant country compared with an increasing share of the rest of the world. As a result, in the coming decade, America could face broad and substantial skill shortages.

Successful implementation of education policies will produce more high-skilled Americans only in the long term. In the short to medium term, America will increasingly need foreign high-skilled workers and will therefore have to reform its high-skilled immigration policies and procedures not only to welcome the best and the brightest but also to make it easier for them to stay.

Meanwhile, as America debates the merits of immigration reform, other rich countries, such as the United Kingdom, Canada, Australia, France, and Germany, have rapidly revamped their high-skilled immigration systems, turning the United States into only one of many destinations for high-skilled immigrants. Moreover, traditional origin countries of high-skilled emigrants to the United States, such as China and India, have actively begun luring their nationals back with special offers.

For America to regain its leadership in global talent, it must urgently reform its high-skilled immigration programs, particularly the H-1B temporary work visa and legal permanent resident (green card) programs. The two programs play a substantial role in bringing in foreign high-skilled workers and permanently keeping them here and could play an even bigger role as demand for high-skilled workers in the US economy increases.

This study verifies that concerns for the plight of American high-skilled workers in the face of significant inflows of foreign high-skilled workers are unfounded. Kirkegaard investigates empirically the labor-market situation faced by US software workers—the group that is usually depicted in the US media as facing the greatest risks from globalization—and reveals that these occupations enjoy full employment at record levels in today's US economy.

New firm-level data on L-1 (intracompany transferees) and H-1B usage for 2006 show that a dozen Indian information technology (IT) companies are the top petitioners for these visas. Several US IT companies are also heavy users of the two visa programs. Beyond the top ten, a very broad range of US and mul-

tinational companies, as well as US public institutions from different sectors of the US economy, account for the demand for foreign high-skilled workers on temporary work visas. Data on visa issuance reveal that Indian nationals dominate both the H-1B and L-1 visa categories.

The legal permanent resident (green card) program is important predominantly as a tool to maintain rather than expand the existing high-skilled workforce in the United States. More than 90 percent of the green cards are issued via adjustment of status (e.g., from H-1B temporary worker to legal permanent resident) requested for high-skilled foreigners already residing and most likely employed in the United States. But national bottlenecks in the current green card system (e.g., per-country limits for countries such as India and China, long waiting periods, and costly and time-consuming application process) may force many employed high-skilled workers to leave the United States once their temporary visas expire.

Based on these findings, Kirkegaard offers a coherent package of proposals to reform the US high-skilled immigration system in a manner that enjoys broad political support:

- drop the Department of Labor (DOL) Foreign Labor Certification (i.e., obtaining DOL's approval for hiring foreign workers) for high-skilled green card recipient categories E-2 (professionals holding advanced degrees or persons of exceptional ability) and E-3 (skilled workers, professionals with bachelor's degree, and unskilled workers);
- exempt green card recipient categories E-1 (priority workers), E-2, and E-3 from the annual per-country national limit;
- drop the DOL Foreign Labor Certification for H-1B workers;
- increase and target enforcement of prevailing wages in intensive users of H-1B visas;
- abolish the annual congressional cap of 65,000 for H-1B visas;
- abolish the annual 20,000 congressional cap and grant automatic H-1B visas to interested foreign master's and doctoral graduates from US universities;
- restrict the share of foreign high-skilled workers that a single business entity over a certain size can employ on temporary work visas—including both H-1B and L-1—to a sensible level of maybe 50 percent;
- strike a bilateral immigration agreement with India and create a new visa category for workers in the IT services/software sector; and
- regularly publish official firm-level immigration data and detailed data on the characteristics of all high-skilled immigrants.

To preview the book, visit <http://bookstore.petersoninstitute.org/book-store/4136.html>.

To learn more about Jacob Funk Kirkegaard, visit

[http://www.petersoninstitute.org/publications/author\\_bio.cfm?author\\_id=274](http://www.petersoninstitute.org/publications/author_bio.cfm?author_id=274).

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# Introduction

*America was indebted to immigration for her settlement and prosperity.  
That part of America which had encouraged them most  
had advanced most rapidly in population, agriculture and the arts.*

—James Madison (1751–1836)<sup>1</sup>

The high-skilled immigration system in the United States is in desperate need of reform.<sup>2</sup> While comprehensive immigration policy made it back onto the US political agenda in the summer of 2007, regrettably little attention is being paid to visa policies and procedures for high-skilled foreign workers, some of which are increasingly becoming arbitrary, time consuming, and costly.

The entire annual H-1B temporary work visa quota available to US businesses was snapped up in less than one day in early April 2007 and, due to oversubscription, had to be allocated based on a random lottery (see chapter 3). And as recently as July 2007, rapidly changing and conflicting US governmental policy decisions on who can file for legal permanent resident (“green card”) status and when confounded sponsoring US employers and high-skilled foreigners working here on temporary visas while waiting for years to adjust their status to permanent residents. The

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*Jacob Funk Kirkegaard is currently residing in the United States on an H-1B visa sponsored by the Peterson Institute for International Economics, which is also sponsoring his pending adjustment of status to legal permanent resident (green card). He is a Danish national, and none of the reforms to the US high-skilled immigration system proposed in this policy analysis will affect his personal situation.*

1. The Debates in the Federal Convention of 1787, August 13.

2. “High-skilled” in this policy analysis, unless otherwise indicated, refers to persons with at least tertiary education—i.e., the equivalent of a four-year college degree or higher.

far-reaching policy decisions were subsequently clarified and partly reversed, but the debacle has undoubtedly lowered foreign workers' confidence in the system and their hope for a permanent future in the United States by significantly adding to the delay in processing of pending applications (see chapter 2).

It must be acknowledged at the outset, however, that historically the US high-skilled immigration system has in many ways been the world's leading such system and retains several well-functioning programs, but its present shortcomings have become increasingly pronounced in the main temporary work visa, the H-1B, and the legal permanent resident programs (see chapter 2). The two programs play a substantial role in bringing in foreign high-skilled workers and permanently keeping them here and could play an even bigger role as demand for high-skilled workers in the US economy increases.

The lack of a serious push to reform these programs is unfortunate because America is in the midst of a transition from its historical position at the pinnacle of the global skills hierarchy to a position where it is struggling to remain even in the world's top 10. This policy analysis presents evidence that in the coming decade, America will face substantial and broad skill shortages and will therefore have to remain attractive to "the best and the brightest."

The long-term economic growth of an advanced country like the United States in the age of rapid globalization is with certainty highly correlated with the skill level of its residents. This is the fundamental insight of growth theory provided by Robert Solow in the 1950s. The skill level in turn depends heavily on both the education and immigration policies of the country.

The combined outcome of these policies is a ready supply of high-skilled workers, which is critical for globally competing businesses. Domestic education policies—for the purposes of this policy analysis, policies that enable a country's young people to get a university degree—are clearly more important because they affect far more people than do immigration policies. The main reason for focusing on tertiary education in this policy analysis is the assertion that this skill level is most required to "learn how to learn." Tertiary skills are the crucial stepping stones to a flexible, fluctuating, and increasingly services-oriented global economy.

The principal objective of any government must be the welfare of its own population, so when considering the overall public response to an increased demand for high-skilled workers, domestic education policies will always retain primacy over immigration policies (which invariably benefit the populations of other countries, as they would otherwise not choose to emigrate).<sup>3</sup> Immigration should not become a substitute for edu-

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3. It will be a laudable goal for a destination country's immigration policies to seek to pro-

cation of the domestic population—the latter, however, is a topic well outside the scope of this policy analysis.

That said, any reform of a country's education system inevitably takes considerable time—likely decades—to have a discernible effect on the skill level of the workforce. It is, for instance, well established that many of the positive economic effects on the US economy of the 1944 GI Bill emerged only many years later.<sup>4</sup> As such, from the perspective of finding a problem-solving policy tool for the short and medium terms, high-skilled immigration policies in a high-wage country like the United States, which (in theory at least) can be altered relatively quickly and have a more immediate impact on a country's supply of high-skilled workers, should be at least partly responsive to the long-term outcome of that same country's domestic education policies. In other words, education policy is a *fait accompli*, whose long-term economic impact policymakers designing high-skilled immigration policies must never ignore.

Large increases in a country's domestic output of university graduates will, *ceteris paribus*, reduce the demand from businesses and other employers for high-skilled foreign workers. On the other hand, stagnating output of domestic university graduates will, *ceteris paribus*, increase the demand for foreign university graduates and put pressure on high-skilled immigration regulation to facilitate this demand. The latter case is of particular relevance, because—as many economists have established—the US economy has during the last decades been experiencing skill-biased technological change, which has raised the relative demand for high-skilled workers in the US economy.<sup>5</sup>

Before proceeding with the analysis, it is useful to consider why high-skilled immigration is different from immigration in general. A country's overall immigration system serves multiple purposes: upholding sovereignty and border control, national security (including aiding local employees working for military forces deployed overseas<sup>6</sup>), and long-held

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mote the welfare of origin countries too. Whether this is on balance the case is a complicated matter beyond the scope of this policy analysis. However, it is most useful to conceptualize high-skilled immigration as exchange-oriented “brain flows” between different countries, rather than zero-sum “brain drains.”

4. Officially titled the Servicemen's Readjustment Act of 1944, the 1944 GI Bill provided returning World War II veterans (commonly referred to as GIs) with college or vocational education as well as one year of unemployment compensation. For its positive impact on the US economy, see, for instance, Bound and Turner (2002) and Eggertsson (1972).

5. There is a vast literature on this subject. For a recent exhaustive overview, see Feenstra (2000); Levy and Temin (2007); Levy and Murnane (1992); Autor, Levy, and Murnane (2001); and Mann (2003, 2006).

6. The current debate on making US visas available to local employees of coalition forces in Iraq—interpreter/translator applicants until recently faced a nine-year waiting period—is another example of the many unintended but potentially highly damaging spillover effects into other policy areas of the current broad-based deadlock on US immigration policy reform. See “Envoy Urges Visas for Iraqis Aiding U.S.,” *Washington Post*, July 22, 2007, A1.

legal and humanitarian traditions, while reflecting national identity politics, for instance. This exhaustive set of priorities, however, is not relevant for the part of the immigration system that concerns high-skilled foreign workers. A sensible high-skilled immigration system involves itself first and foremost with a country's economic growth prospects and should generally aim to appropriately align two traditional "welfare economics" issues, namely enabling a country's employers and businesses to recruit needed high-skilled workers if necessary also from abroad (efficiency) while preserving the interests of the resident workforce (equity).

It would be fortuitous if high-skilled immigration policies in America were reformed as part of a "grand compromise" on immigration encompassing all the different purposes listed above. But it should be clear to all stakeholders that in the event such a "grand compromise" is not politically possible, then holding much-needed high-skilled immigration reforms hostage as a political negotiating strategy puts continuing US economic growth at risk. If US-located businesses cannot get the high-skilled employees they need to get their work done inside the United States, then they will as a matter of simple competitive logic in a global economy be increasingly likely to shift jobs and workplaces to locations outside US borders, where they will have progressively better access to the workers they require. A recent survey by the National Venture Capital Association (2007, 24) of privately held venture capital-backed US companies shows that restrictive US high-skilled immigration laws had influenced the decisions of one-third of such companies to place more personnel at facilities abroad.<sup>7</sup> To reestablish its leadership in global talent, in the short run America will have to revamp its high-skilled immigration policies and processes to not only welcome more highly skilled foreign workers but also make it easier for them to stay.

This policy analysis first shows how America will increasingly require high-skilled foreign workers to buttress its aging skilled workforce and will do so precisely at a time when many other Organization for Economic Cooperation and Development (OECD) countries are reforming their high-skilled immigration regulation to attract highly sought global talent. Second, it focuses on the H-1B and L-1 visa and green card programs to illustrate how the current high-skilled immigration system is characterized by a dual trend: volatile expansion in numbers concerning Indian nationals but relative stability concerning other foreigners. Third, it addresses the welfare trade-off between economic efficiency and worker interests, looks more closely at the labor-market conditions faced by those Americans most affected by high-skilled immigration—software workers—and addresses ways in which immigration policy can best match foreign workers to US employers. Finally, it presents a package of coherent and parsimonious reforms of present US high-skilled immigration laws.

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7. The study singles out the lack of H-1B visas as the major human resources bottleneck.

# High-Skilled Workers: Stagnating in the United States, Rising Fast in Other Countries?

*It's not what we don't know that gives us trouble. It's what we know that ain't so.*

—Will Rogers

The US labor force is highly diverse and dynamic. Yet, intuitively, its long-term average skill level is principally determined by the relative magnitudes of labor-market entries by young workers upon finishing their initial education and exits by retiring older workers.<sup>1</sup> The United States led the world in education throughout the 20th century and benefited greatly from it. It is well known that a country reaps a demographic dividend from quantitatively large young population cohorts entering the workforce.<sup>2</sup> Similarly, in countries like the United States, a positive economic effect has also been felt from the long-term qualitative improvement in the US labor force with less-skilled workers retiring and more high-skilled workers entering the workforce.

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1. The long-term trend is the focus of the first section. Therefore, among many things, it ignores the compositional effects of cyclical changes in hours worked among different groups of workers, as well as the “effective skill effects” from rising levels of experience and continuous lifelong work-related training. Some of these data (in the form of the labor composition index) are compiled annually by the Bureau of Labor Statistics (BLS 2007) for use in computing private business-sector multifactor productivity (MFP). Such “effective skill effects” arise when firms in economic trouble, for instance, lay off workers with least seniority first or blue collar workers ahead of white collar professionals. See also OECD (2007a, 62ff) for a review of the productivity effects of lifelong learning programs in the OECD countries.

2. For a recent overview of this literature, see International Monetary Fund's *Finance and Development*, September 2006.



Many researchers have empirically found such gains to long-term US economic growth from rising skill levels using different methodologies. J. Bradford DeLong, Claudia Goldin, and Lawrence F. Katz (2003) estimate that the combined direct and indirect effects (via research and development and multifactor productivity [MFP]) of rising skill levels in the labor force were the single largest contributor to US economic growth in the 20th century. Other researchers find that an additional year of schooling raises GDP per capita by up to 5 percent and MFP by up to 0.9 percent.<sup>3</sup>

However, this era of broadly rising skill levels in the US labor force is drawing to a close here early in the 21st century. A frequently overlooked side-effect of the imminent retirement of the generally well-educated baby boomer generation is that their retirement will soon take as many high-skilled people out of the US labor force as will simultaneously enter it. This novel development is illustrated in figure 1.1.<sup>4</sup>

## Size and Educational Attainment of Resident US Population

Figure 1.1 shows the detailed educational attainment of the resident US population<sup>5</sup> by five-year age cohort, starting from the age group when people will usually have completed their bachelor's degree (25–29 years) to the age group when they are deep into retirement (age 75+).<sup>6</sup> It is important to

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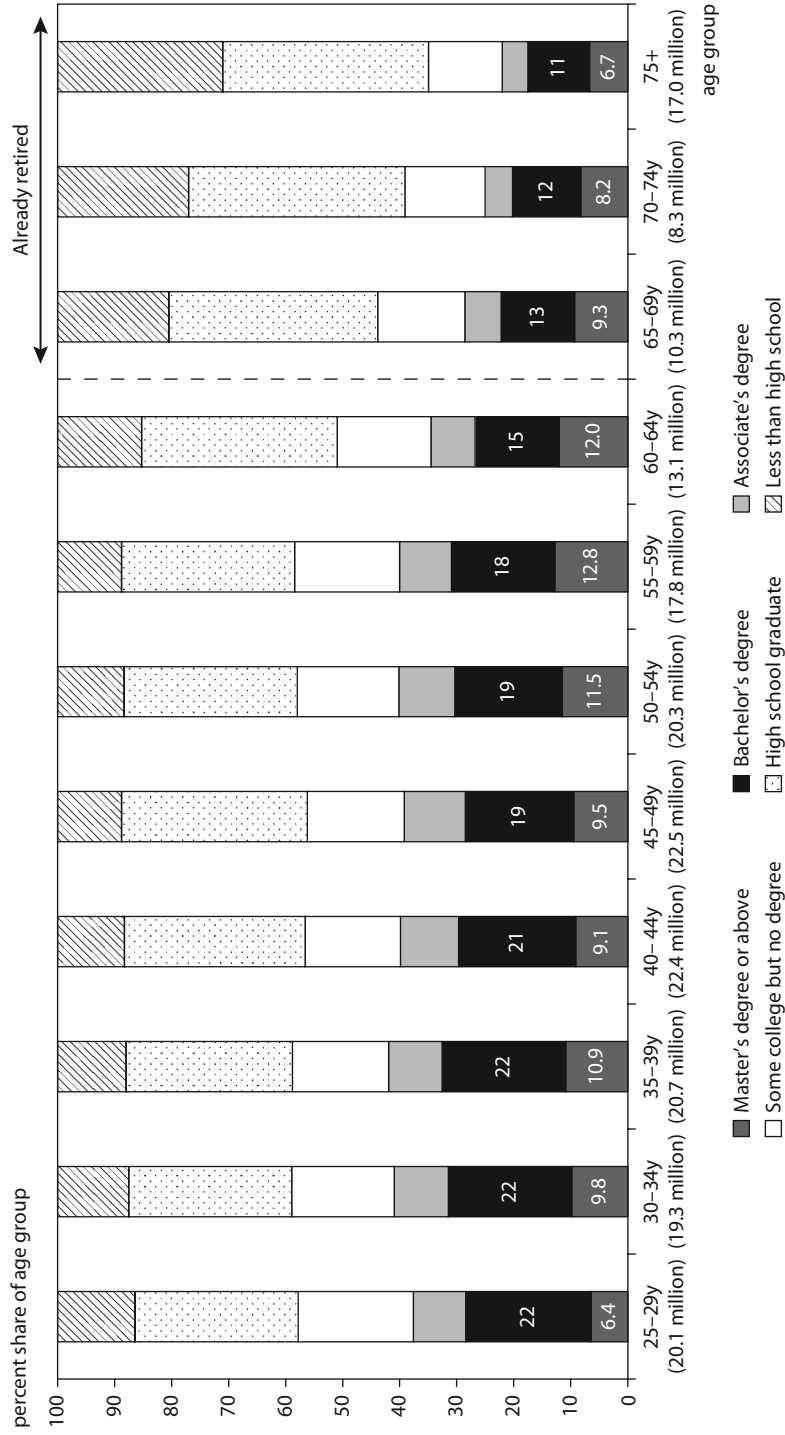
3. OECD (2007a). See also Bassanini and Scarpetta (2001), Cohen and Soto (2007), de la Fuente and Ciccone (2003), and Splitz-Oener (2007).

4. The underlying data for figure 1.1 are presented in more detail in table A.1 in the statistical appendix.

5. These data are from the Bureau of Labor Statistics and the Census Bureau's Current Population Survey, which samples random US households and makes no distinction between US citizens and resident aliens.

6. These data are a snapshot in time and when used here as a “de facto time-series” incorporate the combined share effects of at least four effects active over time: domestic US education (highest level of education attained by Americans in different age groups), immigration (are new immigrants of all ages high or low skilled? For most of the answer, see figure 1.5), lifelong learning (people may choose to go back to school at an older age), and mortality differentials (highly educated people generally live longer than less-educated people). Disentangling these individual effects in detail is, however, beyond the scope of this policy analysis. But these effects work in different directions and therefore do not materially impact the conclusions drawn here. It must be emphasized, though, that lifelong learning is likely less of an uncertainty than many people think, when considering whether people “jump” to one of the higher educational attainment meta-groups depicted in figure 1.1. Usually, lifelong skill acquisition entails acquiring more hands-on skills directly needed to perform a particular job and does not lead to the crossing of educational thresholds into one of the other meta-groups listed in figure 1.1. Most people who do acquire another degree later in life already have a bachelor's or master's degree and therefore do not add to the headcount of the highly skilled by going back to school. Conversation with Barbara Ischinger, director of the OECD Education Directorate, September 18, 2007, at the launch of the *Education at a Glance 2007*:

**Figure 1.1 US educational attainment (highest level attained), 2006**



Source: Bureau of Labor Statistics and Census Bureau, Current Population Survey, 2006 Annual Social and Economic Supplement, available at [www.bls.gov/cps](http://www.bls.gov/cps).

note that figure 1.1 implicitly assumes “fixed thresholds” for entering each category. Hence it assumes, for instance, that a 25–29 year old required the same skill level to get a high school degree as did a 75+ year old.<sup>7</sup>

Figure 1.1 conveys at least two important points: First, the average skill level of the US workforce saw continued improvements up until the time those now aged 55–59 entered the workforce—i.e., until the mid- to late 1970s. The share of unskilled workers (i.e., those with less than a high school degree) declined rapidly, while the number of university graduates rose dramatically. Second, however, American residents aged 25–54 are generally not better educated than their immediately older fellow residents aged 55–59, indicating that the “demographic skills dividend” in the US workforce came to an end in the late 1970s.

Fortunately, the full economic impact of this approximately 30-year stagnation in the average skill level of the US population—covering the resident population from age 25–29 years to 55–59 years—has been delayed until now,<sup>8</sup> as the average skill levels of retiring cohorts aged 65+ have hitherto been below those of younger generations entering the labor force.<sup>9</sup> However, within the next decade, this trend will by and large cease because the 55–59 year olds are just as well educated as today’s labor-market entering “fully educated cohort” aged 30–34.<sup>10</sup> Indeed, as of 2006, there are more holders of master’s, professional, and doctoral degrees among resident 55–59 year olds in America than there are among the 30–34 year olds.<sup>11</sup> In other words, unless the 30-year stagnation among advanced-de-

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*OECD Indicators* publication at the National Education Association in Washington.

7. Some numeracy tests indicate that this assumption may be questionable, as they find evidence that the required level to graduate has declined over time. See, for instance, the 2003 *Trends in International Mathematics and Science Study* (NCES 2004) or the adult literacy survey in OECD/Statistics Canada (2005).

8. Indeed the National Science Foundation in 2005 almost triumphantly announced that the total number of individuals in the United States with at least a college degree rose more than 40 percent from 1993 to 2003—from 29 million to 41 million. This number, however, fails to take into account the rising US total population (up 13 percent from 1993 to 2003) and the rising average age of US degree holders. See National Science Foundation (2005).

9. US labor force participation for the age group 60–64 in 2006 was 52.5 percent but only 29 percent for the age group 65–69, 17 percent for the age group 70–74, and 6.4 percent for the 75+ group. Total labor force participation for the 16+ age group was 66.2 percent. Despite gradually rising Social Security retirement ages, it thus remains accurate to state that Americans on average retire around age 65. The OECD estimates the effective (i.e., taking into account all early retirement programs) age of withdrawal from the US labor force at about 64 years (Bureau of Labor Statistics and Census Bureau, Current Population Survey; and OECD 2006a).

10. “Fully educated” indicates that people usually will not have finished their master’s, professional, or doctoral degrees until reaching the age cohort of 30–34. As such, an educational improvement in the 25–29 age cohort of bachelor’s degree holders should be expected.

11. In 2006 there were 1.61 million master’s degree holders, 305,000 professional degree hold-

gree holders in the resident American population is quickly reversed, a depletion of the graduate degree–holding US workforce seems both imminent and unavoidable.

Given the fundamental economic relationship between supply, demand, and prices, such a scenario will invariably cause earnings inequality between those with high levels (at least a college degree) and those with low levels of education in America to start rising again in the near future.<sup>12</sup> However, as has been the case so far, any additional widening of the wage distribution will not be due to the fact that the US labor force is simply not adjusting fast enough to rising demand for high-skilled workers from technological innovation and international trade. It will be because the US labor force will soon have largely stopped adjusting at all!

The stagnating skills acquisition in the US workforce shown in figure 1.1 can also be described by projecting the share of the total population that can be expected to have acquired tertiary education in the coming decades, given the skill level of those already above age 25 in 2006. This exercise allows for reasonable projections for at least as long as the age groups surveyed in 2006 remain in the population.<sup>13</sup> The US Census Bureau has since 1940 regularly estimated the share of the US population aged 25 and above with at least a four-year college education. These data for select years from 1940 to 2006, as well as projections until 2035, are presented in figure 1.2.<sup>14</sup> However, given that high-skilled people also can be expected to live considerable parts of their lives in retirement, it is useful to consider the share of the “US workforce” that through time has attained tertiary education. Figure 1.2 illustrates this point with the age group 25–64. US

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ers, and 349,000 doctoral degree holders aged 55–59 in America, while there were 1.4 million master’s degree holders, 281,000 professional degree holders, and 199,000 doctoral degree holders aged 30–34. See table A.1 in the statistical appendix. Auriol (2007) also presents data showing that of six out of seven surveyed countries—Canada, Argentina, Germany, Australia, and Switzerland—the United States has the oldest PhD population on average, with doctoral degree holders from Portugal being older.

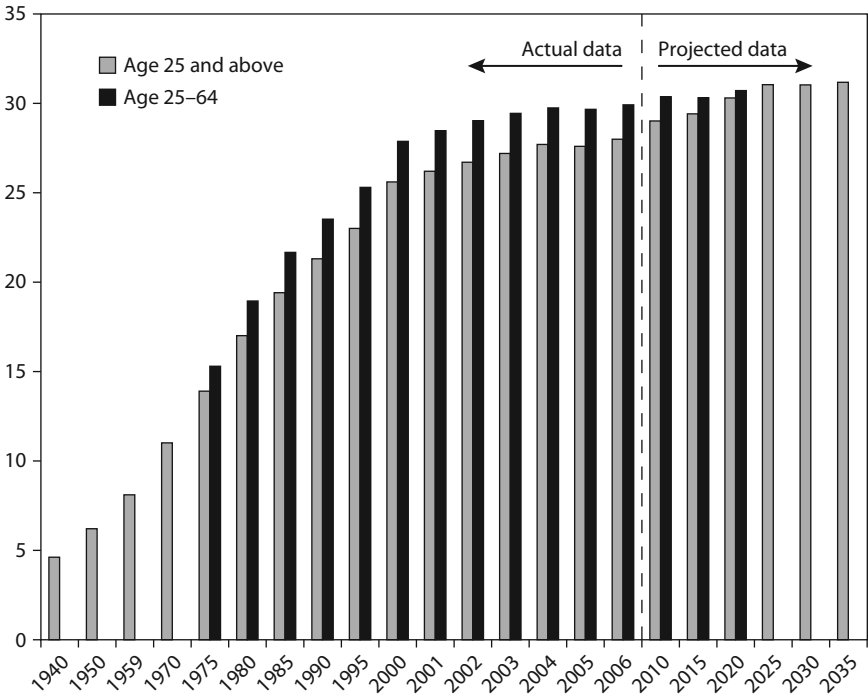
12. The Economic Policy Institute (EPI) estimates that the wage premium for college relative to high school graduates reached 47.1 percent in 2005. This wage premium, however, has been essentially stagnant since 1995, when it reached 46.7 percent, which was preceded by an increase from less than 30 percent in the late 1970s. See EPI datazone at [www.epi.org/datazone/06](http://www.epi.org/datazone/06). See also Lawrence (forthcoming).

13. The projection methodology used here assumes that the educational attainment of age groups 25–29 and 30–34 will be retained throughout the projection period, such that the 2006 share of the 30–34 age group will be held constant into the future as older age groups surveyed in 2006 exit the relevant age group. Individual age groups are then weighted by their share of the total relevant age group population total. Note that no adjustment is made for differences in mortality rates among people of different educational attainment, immigration, or lifelong learning in these projections.

14. By 2035 the age group 30–34 surveyed in 2006 will have passed into the oldest 75+ age group, and the projections become flat by assumption thereafter.

**Figure 1.2 Share of the US workforce with at least tertiary education, 1940–2035**

percent share of total population  
in age group



Sources: Bureau of Labor Statistics and Census Bureau, Current Population Survey, available at [www.bls.gov/cps](http://www.bls.gov/cps); author's calculations.

Census data at this level of age detail go back only to the mid-1970s, so there is not enough information to project this age group beyond 2020.

Two distinct trends are visible in figure 1.2: First, the rapid rise in the share of the US population aged 25 and above that had attained tertiary education started slowing dramatically just after 2000 and will slow even further going forward. Second, part of this continued slower rise after 2006 comes from the continued rise in the share of highly skilled people over 65. By about 2020, Americans 65 years and above—the overwhelming majority of whom will be in retirement—will be about as well educated as the US workforce in the 25–64 age group, the usual workforce age range. To retain this group of elderly high-skilled Americans in the workforce in coming decades poses a significant challenge.<sup>15</sup>

15. For the labor-market challenge of aging high-skilled populations, see also Baily and Kirkegaard (forthcoming).

If one takes “equal opportunity for all” in America seriously and believes that every American truly has access to as much education as he or she demands and desires, then this observed stagnation in skill levels at late 1970s levels would point to a “revealed preference” and likely to a resulting maximum skills capacity of the resident US population. This stagnation would again indicate that it occurred near the pinnacle of what a large population like America’s can realistically achieve, assuming that everyone finishes as much education as he or she individually desires. After all, not everyone can possibly graduate from university.

If this indeed were the case, then one would not need to lose too much sleep over this stagnation, as there would be no compelling reason to believe that populations in other rich countries would be able to do any better than potentially catch up with the overall US skill levels reached in the late 1970s. Alas, a look at internationally comparable statistics from the Organization for Economic Cooperation and Development (OECD) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) quickly dispels such notions.

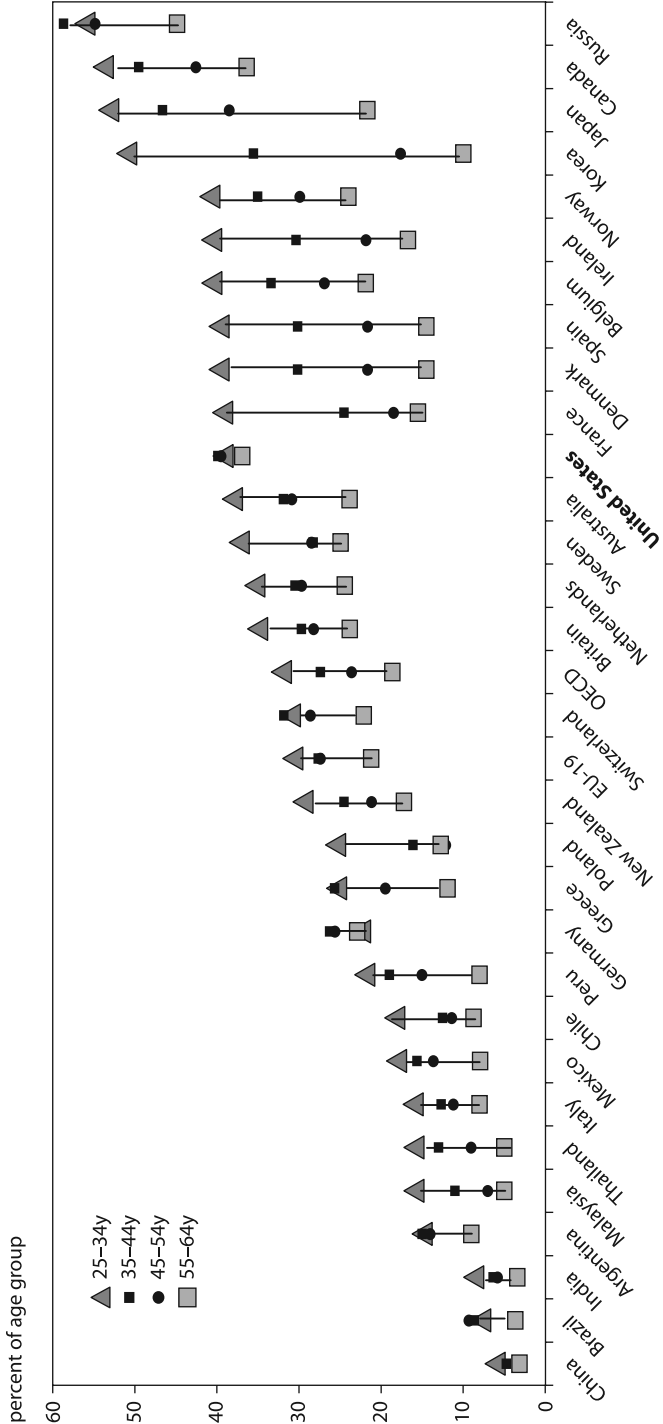
Figure 1.3 presents a different calibration of internationally comparable “de facto time-series data” similar to those presented in figure 1.1 for the United States. The way to interpret figure 1.3 is to look at the difference (i.e., vertical distance) between the age groups. The larger the difference, the bigger the improvement in educational attainment among different age groups in the resident population—the 30-year time-series chronology in figure 1.3 goes “big square-circle-small square-big triangle.” The countries are ranked by the educational attainment of age group 25–34.

It is important to note that no attempt is made in figure 1.3 to “adjust for quality differences” in tertiary educational experiences between countries. Of course, not every university around the globe is a Harvard, Stanford, Cambridge, or Indian Institute of Technology, so invariably considerable “skill aspects” are not included in figure 1.3. Such comparisons are significantly beyond the scope of this policy analysis. However, following the axiom that tertiary training is what principally enables individuals to quickly grasp new complex subjects and therefore makes it easier to train them on the (especially services-sector) job, it seems evident that in terms of describing the overall level of high-skilled workers in different countries’ workforces, any impact of quality differences among universities will be swamped by the quantitative differences in tertiary skill uptake depicted in figure 1.3.<sup>16</sup>

Several things are clear from figure 1.3: First, Americans aged 55–64 by and large were the most highly skilled “free-market generation” of

16. See also data (presented later) on the share of foreign students at US universities. Their rising numbers further hamper any attempt to “adjust for quality differences” in university experiences between countries.

**Figure 1.3 Share of population with tertiary education, by age, 2005**



Note: Tertiary education means at least a college degree. Data are for 2005 or latest available from 2003-04. The way to interpret this figure is to look at the difference (i.e., vertical distance) between the age groups. The larger the difference, the bigger the improvement in educational attainment among different age groups in the resident population—the 30-year time-series goes “big square-circle-small square-big triangle.” The countries are ranked by educational attainment of age group 25-34. Sources: UNESCO/OECD World Education Indicators; OECD (2007d); for China: National Bureau of Statistics of China (2005); for India: Ministry of Statistics and Programme Implementation (2005).

their time, beaten only by their Russian counterparts, who until 1991, from the perspective of competing workers, were “securely” imprisoned by the absurdities of communism and a centrally planned economy.<sup>17</sup> As such, no group in the world would have been in a better position to take advantage of trade liberalization and the opening up of global markets in the latter part of the 20th century than this group of Americans. There is little doubt that this erstwhile skill superiority of the US population has been the backbone of US political support for free trade in the 20th century (Scheve and Slaughter 2001). Stated in another way, up until and including the time when Americans aged 55–64 entered the labor force, America had, in Heckscher-Ohlin terms, abundant skilled labor among resident labor-market entrants relative to the rest of the world.<sup>18</sup>

Second, it is evident from figure 1.3 that the skill level expressed in terms of university education that America achieved in the late 1970s and has barely maintained since is not particularly impressive in the 21st century when compared with other countries. While the United States and Germany<sup>19</sup> are unique among OECD countries in having seen stagnating or declining average skill levels by this broad measure over all four age groups presented in figure 1.3, the educational attainment in many countries has continued from generational cohort to generational cohort in recent decades to soar past the levels achieved in the United States. Most impressive is South Korea, which has seen the share of university graduates among labor-market entrants rise from 10 to 50 percent in the approximately 30-year period captured in figure 1.3. Many other countries have also seen dramatic improvements—Japan, Canada, France, Spain, the Scandinavians, and Ireland are all at or significantly above the skill level found among US residents aged 25–34.

Moreover, it is noteworthy that while the average skill levels in Russia have stagnated in the last 20 years—which is not too surprising given the economic turmoil and crisis in the country—this stagnation has occurred at a much higher average skill level than in the United States (or Germany). As such, while their parents may have been “the brightest kids on the global trading block” when they entered the workforce, younger

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17. On the other hand, the ability of a Soviet-style planned economy to “order” the production of a large number of university graduates should clearly not be underestimated.

18. The United States led the industrialized world in educational attainment from early in the 20th century; see Goldin (2001) and Goldin and Katz (2003). This supremacy was achieved by an education system that in the words of Goldin (2001, 3) was characterized by “public funding, openness, gender neutrality, local (and also state) control, separation of church and state, and an academic curriculum.” See also Leamer (1984).

19. For a description of the dismal state of German university education, see, for instance, Burda (2006a, 2006b).



Americans today barely make the global top 10.<sup>20</sup> Simply put, America in the 21st century is no longer a skill-abundant country relative to an increasing share of the rest of the world.

Third, with the best-educated 55–64 year olds in the world, America faces an imminent disproportionately larger skills drain into retirement than other industrialized countries. Even if the skill levels of the resident workforce in, say, Canada or other countries with continuous improvements started stagnating today as they did in America in the late 1970s, it would still be about 30 years before they faced the same relative skill drain into retirement that America presently confronts. Should these countries find themselves in a similar situation (ignored so far by policymakers in Washington), they will have ample time for long-term reforms of their education system.

At least three issues emerge from the two trends in workforces described so far in this chapter—i.e., stagnating US university-degree skill levels since the late 1970s and accelerating relative decline versus other industrialized nations.<sup>21</sup> First, a relatively broad-based skills shortage in the United States extending significantly beyond the “usual suspect” fields of science and technology (see below) seems probable in the medium term. This shortage seems likely to accelerate already high US wage differentials between high- and low-skilled workers. The data in figure 1.1 thus should serve to allay many broader concerns about the labor-market situation facing high-skilled Americans in the coming decades.<sup>22</sup>

Second, the economics literature is fairly clear that skill levels overwhelmingly determine the attitudes of rich-world populations toward free trade<sup>23</sup>: High-skilled workers broadly favor free trade and vice versa. In light of the stagnation seen in US skill levels in the last 30 years, it is not surprising that age generally has little discernible effect on perceptions toward international trade.<sup>24</sup> However, one may speculate that the relative decline in skill levels among younger Americans versus their counterparts in other industrialized nations and developing economies like China

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20. This is also reflected in the fact that in the late 1970s, 30 percent of the world's university students were in America; today that share has declined to 14 percent (NCEE 2007).

21. This accelerating decline arises from both a lower share of university degree holders among labor-market-entering cohorts and relatively higher numbers of university-trained retirees.

22. The US Census Bureau (2007, table 613) shows that the unemployment rate among college graduates has since 1992 consistently been more than 1 percent below that among non-graduates and always about or below 3 percent or essentially full employment.

23. See, for instance, Scheve and Slaughter (2001).

24. See, for instance, Scheve and Slaughter (2001) or the German Marshall Fund (2006, question 3.2) for another recent survey showing virtually similar views toward international trade among Americans of different age groups.

and India<sup>25</sup> may start eroding support for international trade among this group.

Third, and of most direct interest to this analysis, America will feel the full impact of the 30-year stagnation in skill levels in the US workforce when many baby boomers begin retiring, which makes expeditious reform of US high-skilled immigration policies imperative. Urgent reforms of the broader US education system<sup>26</sup>—even if immediately and successfully implemented—will produce more young American graduates only in the long term. However, in the short term—say at least over the next decade—only high-skilled immigration can provide American employers with the skilled workforce they need to continue to compete and expand in a global skills-biased economy.

## Size and Educational Characteristics of Foreign-Born Populations in Rich Countries

The broader US debate on immigration is occasionally framed within the perception of “American exceptionalism” (Lipset 1996)—that America is the number one destination of immigrants in the world and that US borders are far more open to immigrants than almost anywhere else in the world. This perception is partly rooted in US history—that America was a “New World immigrant nation.” Numerically, the United States does take in far more immigrants than any other country today, but it is important to distinguish between simple “immigration size effects”—the United States welcomes more immigrants than other countries because it is a bigger country and has a larger population—and “large-scale immigration.” While the United States continues to welcome many immigrants today, it probably welcomes fewer immigrants relative to other rich countries than many Americans believe. This section provides recent comparative data for the OECD countries to illuminate this issue.

One must first carefully and coherently define “immigrants” across different countries. This superficially simple task is severely inhibited by axiomatic dissimilarities in the way different countries organize their

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25. It is clear that economic liberalization in both India and China in recent decades has brought millions of new highly skilled workers into the global labor force. This, however, is a one-off stock effect almost exclusively the result of trade policy liberalizations and not directly related to longer-term improvements in the average skill levels of the Chinese or Indian populations. Moreover, it can be seen in figure 1.3 that both countries are rapidly expanding the number of university graduates each produces, albeit from a very low base. It is less clear that many of these graduates are all truly available to the global economy. See, for instance, McKinsey Global Institute (2005) for estimates that perhaps only as few as 10 percent of Chinese graduates are truly part of the global workforce.

26. See NCEE (2007) or OECD (2007b) for a list of required reforms.

population censuses. Some define immigrants as foreign nationals—i.e., current residents with foreign citizenship. Given the very large differences among OECD countries in access to citizenship—for instance, it has been traditionally relatively easy to acquire citizenship in most Anglo-Saxon countries while extremely difficult, if not outright impossible, in “blood-line oriented” countries like Germany or Japan—such methodological issues may completely invalidate cross-country comparative data.<sup>27</sup>

Instead, one can use the concept of “foreign-born” from the OECD’s Database on Foreign-born and Expatriates<sup>28</sup>—i.e., a resident person born outside the country in question—as a possible intuitively valid definition of “an immigrant.”<sup>29</sup> The “foreign-born” definition eliminates any differences in countries’ rules for granting citizenship, and valid cross-country data may thus be presented. The “foreign-born” definition, however, ignores cultural or ethnic differences among people born in a given country. The OECD database further relies exclusively on national census data and therefore to the degree that these data are included in the database, it also covers estimates for illegal immigration. Illegal immigrants are thus included in the “foreign-born” data for the United States.

Figure 1.4 shows that while the share of foreign-born in the US population was relatively high in 2005, it was by no means among the highest in the OECD. Other traditional Anglo-Saxon destination countries like Canada and New Zealand, for instance, had shares of foreign-born population fully 50 percent higher than that of the United States, while Australia’s was almost double that of the United States. Alpine countries such as Switzerland and Austria also had a higher foreign-born population share than the United States.<sup>30</sup> It is thus erroneous to assume that US borders have been much more open than many other countries or that in relative numeric terms the United States is more of a destination country than many other countries.

The fact that the foreign-born population shares in several continental European countries like Germany, Sweden, Belgium, the Netherlands, and Greece are more than 10 percent—quite similar to, if slightly below, the US level—further underlines the fact that the levels in the United States are far from unusual and certainly not exceptional.

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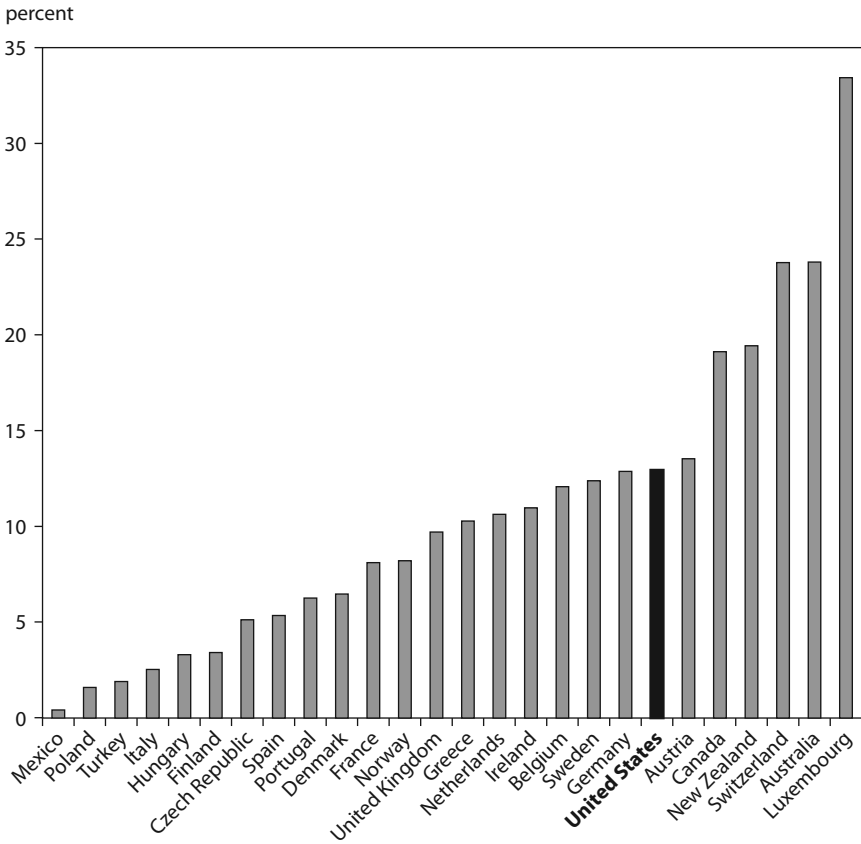
27. See Dumont and Lemaitre (2005) for details.

28. The database covers all aged 15 and above. It is available at [www.oecd.org](http://www.oecd.org).

29. For US data, foreign-born is defined as anyone who is not a US citizen at birth. They include naturalized US citizens, lawful permanent residents (immigrants), temporary migrants (such as students), humanitarian migrants (such as refugees), and persons illegally present in the United States. The latter—illegals—is an important inclusion in US data. See the Census Bureau’s website at [www.census.gov](http://www.census.gov).

30. See also Lowell (2007) for immigration data for the 1975–2005 period, which show a significant rise in immigrant populations across the developed world.

**Figure 1.4 Foreign-born population as share of total population, 2005 or latest available**



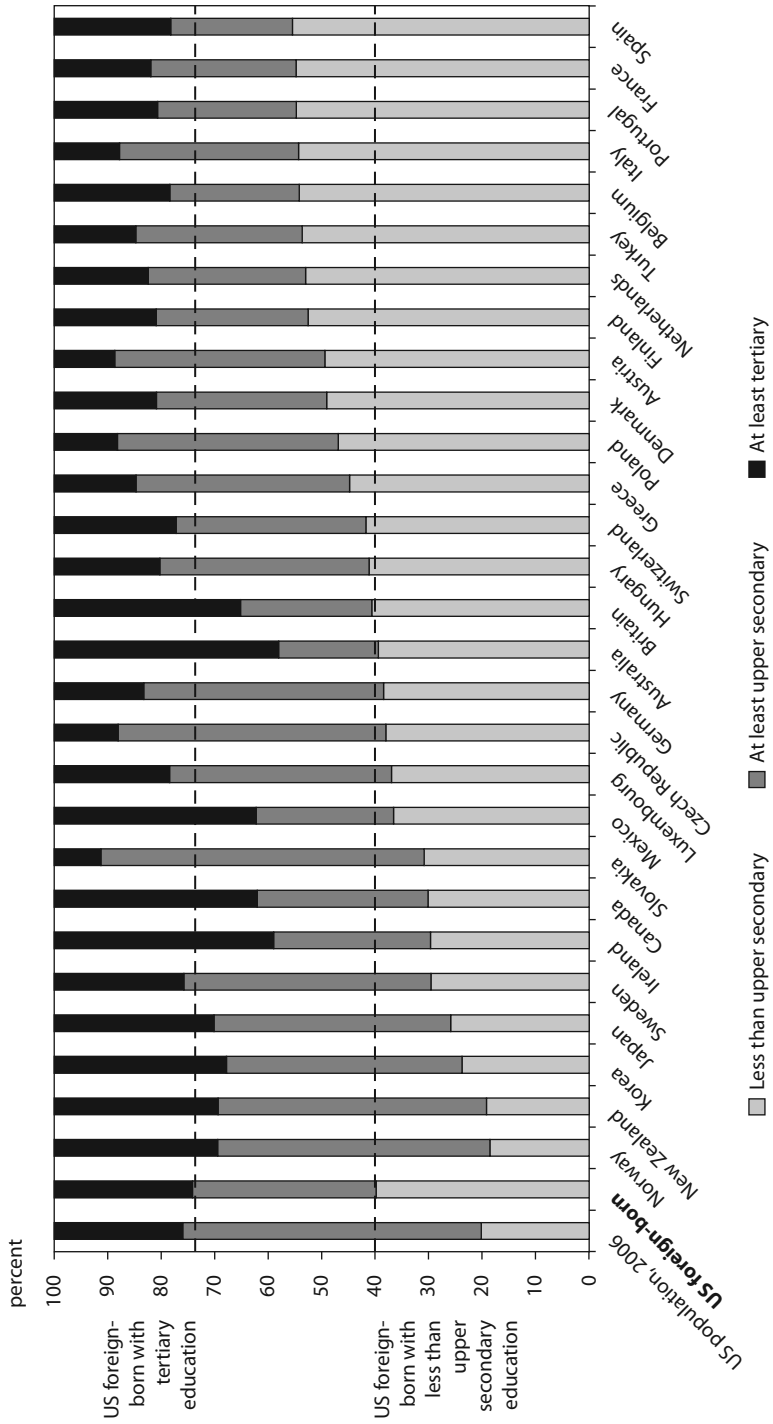
Source: OECD (2007c).

In addition, some commentary on US immigration is rooted in the belief that the immigrant population here is disproportionately low skilled. The most recent data on the educational attainment of foreign-born populations in the OECD are presented in figure 1.5.<sup>31</sup>

The figure illustrates several points: The first bar shows the educational attainment of the entire US population 15 years and older in 2006

31. All foreign-born whose educational attainment could be ascertained are included. In some countries, though not the United States, some foreign-born were coded as “unknown” in the OECD database. Generally, the “unknowns” represented a small share (less than 20 percent) of the total number of foreign-born. As there is no immediate reason to believe that the “unknowns” category is systematically biased toward any particular educational category, its exclusion from the data in table A.1 will not impact the conclusions drawn.

Figure 1.5 Educational attainment of foreign-born population, 15 years and above, circa 2000



Sources: Bureau of Labor Statistics and Census Bureau, Current Population Survey, available at [www.bls.gov/cps](http://www.bls.gov/cps); OECD Foreign-born and Expatriates Database.

from the same data source in figure 1.1. The second bar shows the latest available data on the educational attainment of the US foreign-born population. The foreign-born population has slightly more high-skilled people (those with tertiary education) than does the entire US population. By this metric, therefore, the immigrant population is as skilled as the US population at large and decisively not low-skilled relative to the total US population.

However, figure 1.5 shows that the share of foreign-born population with less than secondary education is twice as large (40 percent) as that for the US population as a whole (20 percent). This difference may sound quite dramatic. However, recall that the demarcating feature between having attained at least upper secondary education and not having done so is whether an individual has graduated from high school or not. What figure 1.5 ultimately translates into is that, if one more out of every ten immigrants who have come to the United States had graduated from high school, the foreign-born population would in terms of educational attainment essentially have mirrored the US population as a whole.<sup>32</sup> This difference is definitely not trivial, but it hardly constitutes a flood of relatively low-skilled workers either. Indeed, figure 1.5 seems to validate descriptions of the US immigrant population as being “hourglass shaped” with many high-skilled and many low-skilled individuals.<sup>33</sup>

Equally important, figure 1.5 shows that the overall educational attainment of the US foreign-born population circa 2000 was far from unusual. Several countries have far larger shares of high-skilled foreign-born residents than the United States. The same is true for shares of low-skilled immigrants: A majority of European countries have significantly higher shares of foreign-born residents with less than upper secondary education than does the United States.

The bottom line: The United States is certainly big in immigration terms, but there are few traces of exceptionalism.

## High-Skilled Workers in Science and Engineering

A frequently voiced concern about the economic future of the United States is the declining interest among younger Americans in the “hard sci-

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32. Note further that the relative similarity between the foreign-born population and the US population as a whole enhances the validity of the “time-series use” of the Census Bureau data in figure 1.1. It seems unlikely that any of the particular age cohorts will have been systematically affected in a biased manner by inflows of immigrants.

33. Passell (2007) shows that a higher share of legal immigrants in the United States had at least a college degree than did the US native population in 2005. Smith (2006) shows that the disparity in the number of school years completed between foreign-born aged 25+ and all native-born aged 25+ declined from 2.1 years in 1940 to just 1.3 years in 2002.

ences” of science and engineering (S&E) and the subsequent acute shortage of workers in these fields. It is beyond the scope of this policy analysis to explore this concern in depth,<sup>34</sup> but figure 1.6 on total number of US graduates and share of S&E graduates illustrates a few key points.

First, the relative stagnation in US education since the late 1970s can also be noticed in figure 1.6. While the total number of US graduates at all levels may have continued to rise every year, only up until the mid-1970s did it rise sufficiently fast to also increase as a share of the rising total US population.<sup>35</sup> Figure 1.6 shows that the relative interest in S&E—measured as a share of total graduates at the undergraduate, graduate, and doctoral levels—has hardly declined since at least the mid-1970s. As such, the issue is rather a decline in interest in general educational improvement, as opposed to a relative decline in interest in S&E.

Some might say that these S&E numbers are relatively stable only because today—unlike in earlier decades—many S&E students at America’s universities are foreigners rather than American citizens. This is definitely true but not as true as many think when one looks at recent data.

Figure 1.7 shows that the share of foreign graduate S&E students on temporary visas—i.e., neither US-born nor permanent residents—has increased substantially in the last 25 years, even though a recent 9/11-related decline can clearly be identified.<sup>36</sup> However, it is noteworthy that this gradual 25-year increase came from an already relatively high level as early as 1980.<sup>37</sup> At no point since at least 1980 has the foreign share of total engineering graduate students in the United States been below 40 percent. The same has been true for mathematical, physical, and computer sciences since the mid-1980s. In other words, the heavy reliance on foreign S&E students is not a novelty at US universities but has been the state of affairs for at least a generation.

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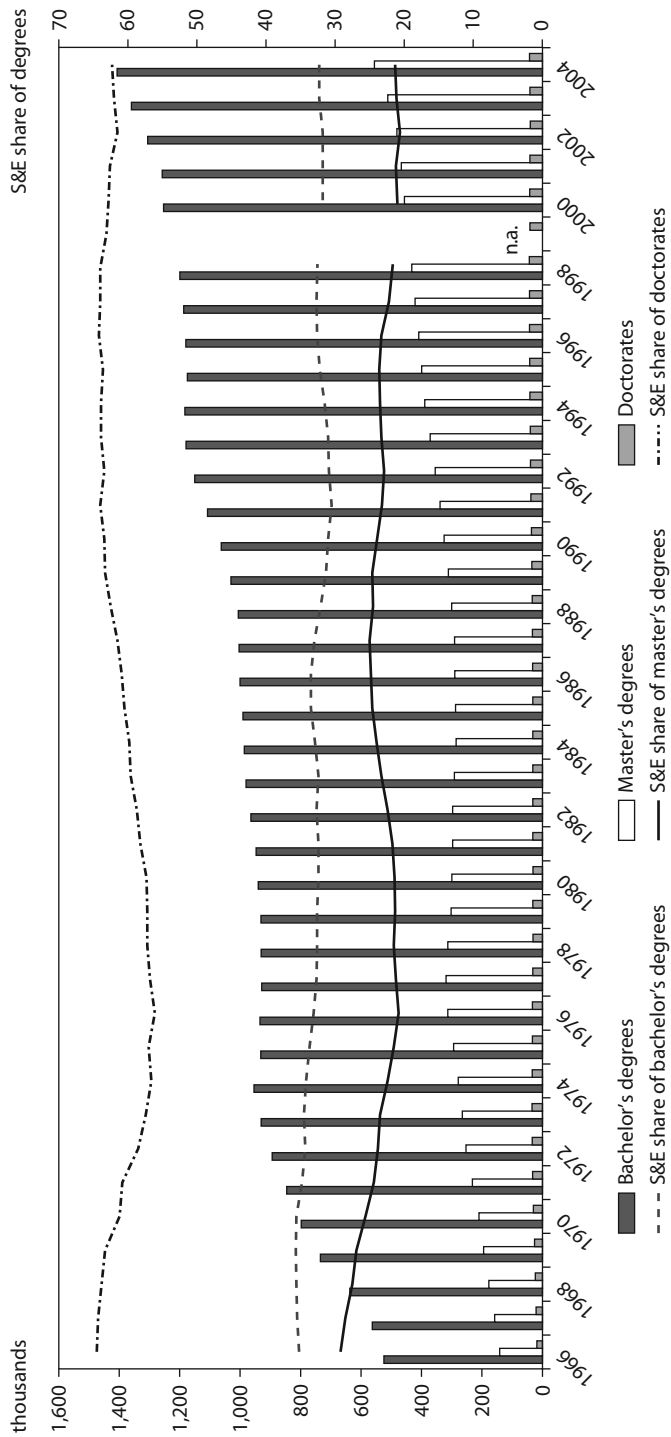
34. See, however, National Science Foundation, *Science and Engineering Indicators 2006*, available at [www.nsf.gov](http://www.nsf.gov).

35. This excludes the four effects from footnote 6, namely immigration, lifelong learning, demographics, and mortality.

36. The effects of 9/11 arise from several issues: tightened US visa requirements, the perception among foreign students that “getting a US visa is hopeless” and their subsequent pursuit of graduate education elsewhere, and aggressive marketing by other destination countries positioning themselves as post-9/11 alternatives to the United States for prospective graduate students from third countries. Note, however, that more recent data from the Institute for International Education (2006) for total foreign student intake by US universities show a rebound in 2005–06.

37. Data from the Institute for International Education (2006, table on International Students by Academic Level, Selected Years 1954/55–2005/06) covering the period from the mid-1950s for the total number of foreign students among US bachelor’s, master’s, and doctoral students indicate that their numbers swelled dramatically during the 1970s from earlier relatively low levels.

**Figure 1.6 Annual number of degrees awarded at US universities and S&E share of degrees, 1966–2004**



S&E = science and engineering

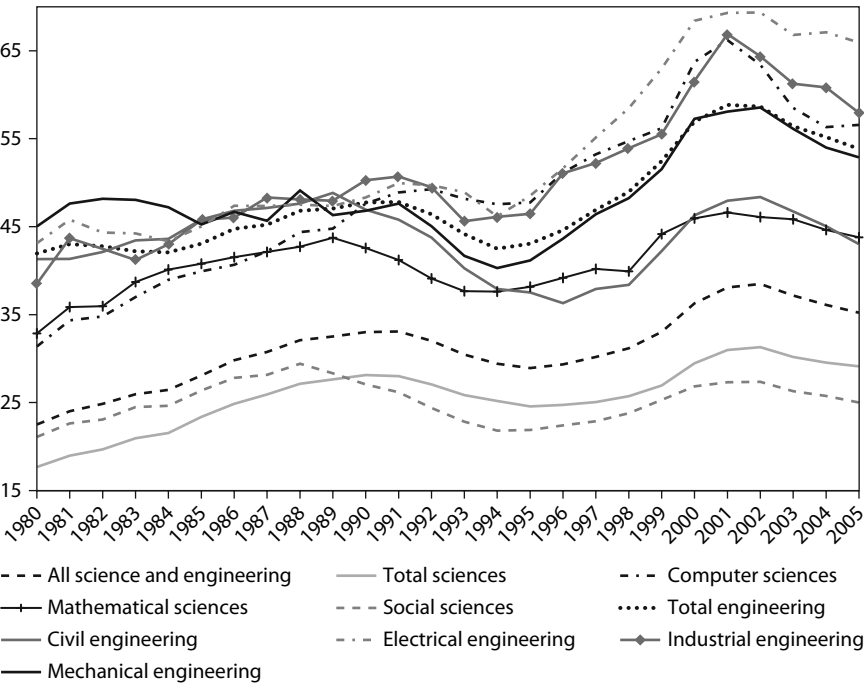
Note: Data for bachelor's and master's degree holders not available (n.a.) for 1999.

Source: National Science Foundation (2007).



**Figure 1.7 Foreign science and engineering students at US universities, 1980–2005**

percent share of full-time graduate students on temporary visas



Source: National Science Foundation (2007).

The real issue at present is therefore not that more foreigners are studying S&E in America (they clearly are) but whether or not the United States can maintain its traditionally very high retention rate among highly skilled foreign S&E students. A significant number of these students have historically remained and taken jobs in America upon graduation instead of returning to their countries of origin. Slightly old data from the National Science Foundation (1998) indicate that from 1988 to 1996, approximately two-thirds of foreign S&E doctoral recipients planned to stay in the United States, with the share rising to 79 percent for Indians and 86 percent for Chinese recipients.<sup>38</sup> On the other hand, only 36 percent

38. Slightly more recent data in Finn (2005) show that 61 percent of all foreign S&E doctoral

of Korean and 48 percent of Taiwanese recipients intended to stay. As citizens from these four Asian countries accounted for almost 80 percent of all foreign recipients, their intentions mattered. It is noteworthy that the US retention rate among Asian recipients from the more developed economies of South Korea and Taiwan was significantly lower than for China and India. This raises the issue of whether, as China and India gradually achieve developed-economy status and other countries accelerate their intake of Chinese and Indian immigrants,<sup>39</sup> the United States will be able to continue to hold on to the vast majority of S&E graduate students from these two countries or whether Chinese and Indian students will become as likely as South Koreans and Taiwanese to return, as economic opportunities in their home countries and elsewhere improve.

More recent, but less geographically detailed, data from Auriol (2007) indicate that in 2003, fully 40 percent of all recent foreign doctoral degree recipients in the United States intended to leave, indicating that the US labor market may not be quite as attractive as it was in earlier decades. Should this trend of departing foreign graduate and doctoral S&E students accelerate, it would pose a substantial threat to the supply of S&E skills to the US workforce.<sup>40</sup> (See box 1.1.)

At the same time, however, Auriol (2007) also shows that recent doctoral degree recipients who are US citizens are very immobile compared with their noncitizen counterparts, with only 5 percent intending to leave the United States. This indicates that the United States does not suffer any significant hemorrhage of domestic doctoral students and that expeditiously granting foreign students US citizenship could be an effective way of keeping them in the United States after graduation (see also chapter 3).

The age profile of the exiting S&E workforce further accentuates the need to continue to retain a very high level of foreign students in the US workforce. Figure 1.8 shows that, while the age profile of the degree-holding S&E workforce is perhaps slightly younger than the overall university-educated US workforce,<sup>41</sup> a substantial number of S&E degree holders

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degree recipients in 1998 worked in the United States five years after graduation—i.e., in 2003.

39. Data from OECD (2007c, figure I.8) show that the 2005 share of inflows of Chinese and Indians to all OECD countries with available data (including the United States), except Spain, Italy, Hungary, and the Czech Republic, were significantly above the share of Chinese and Indians in the countries' total stock of foreign immigrants, indicating a relative acceleration in intake from these two countries.

40. This threat is highlighted by the American Electronics Association (2005, 2007).

41. This is not surprising, because computer sciences as a field of study, for instance, has existed in scale only for about 25 years; it hardly existed when the 55–59 year olds entered the workforce.

### **Box 1.1 The high-skilled immigrant entrepreneur—shut out at America’s increasing peril**

The entrepreneurial zeal of many immigrants in America is well known and can be witnessed when walking on the streets of any American city today: A number of restaurants, grocery shops, convenience stores, or dry cleaning businesses are very likely to have been started by recently arrived immigrants. Undoubtedly, this constant inflow of entrepreneurial zeal—and the possibilities to utilize it in a lightly regulated economy—represents one of the biggest economic advantages America has over other countries in the 21st century. This advantage is also captured in the 2006 Kauffman Index of Entrepreneurial Activity, which shows that the incidence of entrepreneurship among immigrants as a whole was on average 25 percent above that of native-born Americans in the decade from 1996 to 2005.<sup>1</sup>

Immigrants are also increasingly becoming a very important component of America’s treasured high-tech entrepreneurs. A survey by Duke University and University of California–Berkeley (2007) shows that fully one-quarter of all newly founded engineering and technology firms in America between 1995 and 2005 had at least one foreign-born founder, while in the Silicon Valley area, this share rose to more than half (52 percent). In software, computer/communications technology, and semiconductors, the shares of foreign founders were all over one-quarter the national US average. By 2006, these US engineering and technology companies, fully or partly founded by immigrants in 1995–2005, employed a total of 450,000 Americans and had annual sales of \$52 billion.

Another survey carried out by the National Venture Capital Association (2007) of all publicly traded venture capital–backed companies founded since 1970—the vast majority of which can be assumed to have been founded by high-skilled individuals—showed similar results. The survey found a substantial rise in the share of immigrant-founded venture capital–backed companies in America. The share rose from just 7 percent in 1970–80 to 20 percent in 1980–89. This corresponds closely with the finding in this chapter that starting as early as 1980, a large share of science and engineering (S&E) graduate students at US universities were foreign nationals. The share of immigrant-founded venture capital–backed publicly traded companies in America rose to 25 percent between 1990 and 2005. In other words, as all immigrant-founded venture capital–backed companies have been in “S&E type” sectors,<sup>2</sup> it is clear that the large and increasing share of foreign S&E students in America is being directly reflected in America’s population of high-skilled entrepreneurs.

Certainly, some successful high-tech firms will be founded by Bill Gates–like college dropouts<sup>3</sup> or others with irrepressible new ideas, but the overwhelming majority of them have been and will continue to be founded by highly skilled people with

*(box continues next page)*

### **Box 1.1 The high-skilled immigrant entrepreneur—shut out at America’s increasing peril** (*continued*)

university degrees in S&E fields. If America wishes to benefit from new eBays, Yahoo!s, or Googles<sup>4</sup> in the future, it must not only maintain its flexible business startup-friendly economy but also ensure that tomorrow’s high-skilled technology entrepreneurs gain access into the country in the first place.

1. This index measures the percent of individuals (aged 20–64) who do not own a business in the first survey month but start a business the following month, working 15 or more hours per week (Kauffman Foundation 2006).
2. The sectors involved were high-tech manufacturing; information technology; life sciences; professional, scientific, and technical services; other services; other manufacturing; finance and insurance; and e-commerce (National Venture Capital Association 2007).
3. Incidentally, Harvard University still considers Bill Gates a member of its Class of 1977, despite the fact that he himself claims to have left Cambridge of his own volition in 1975 before graduating. See *FT Observer*, June 5, 2007.
4. eBay’s cofounder Pierre Omidyar is French, Yahoo!’s cofounder Jerry Yang is from Taiwan, and Google’s cofounder Sergey Brin was born in Russia.

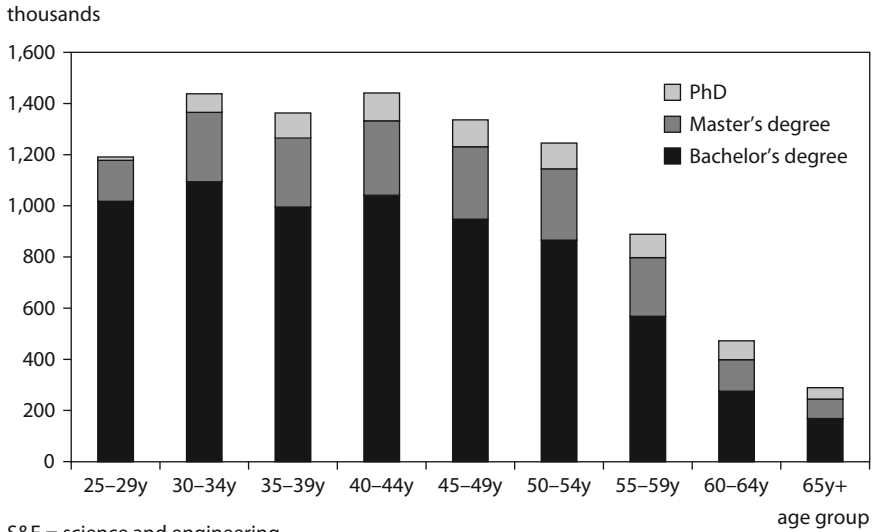
will nonetheless in the coming decade pass into some form of retirement.<sup>42</sup> Moreover, as is the case with the degree-holding US population, younger cohorts aged 30–34 with S&E degrees are not substantially more numerous than their colleagues 20 years older. Unequivocally, therefore, America will (continue to) become ever more reliant on retaining US-trained foreign high-skilled S&E talent in the workforce, both because their share of supply is rising and because the existing stock will increasingly be retiring.

It is beyond the scope of this policy analysis to discuss required reforms of the broader US S&E education system,<sup>43</sup> but the data in this section raise at least two S&E immigration-related issues: US high-skilled im-

42. Figure 1.8 shows that more than 300,000 individuals aged 65+ remained in the US labor force in 2003. However, as pointed out in chapter 3 of the National Science Foundation, Science and Engineering (NSF S&E) Indicators 2006, exact retirement age is a complex matter, with part-time jobs frequently replacing previous full-time employment. Table 3.16 in NSF S&E Indicators 2006 shows that by age 62, more than half of all S&E bachelor’s and master’s degree holders had retired from all types of employment in 2003, while half of the doctoral degree recipients had retired by age 65. The same publication’s annex table 3.14 shows that by age 65, just 31 percent of S&E bachelor’s and master’s degree holders worked full time, while 53 percent of the PhDs did so. This figure corresponds to a total US labor force participation for the 60–64 year olds in 2003 of 51 percent (and rising), 27 percent for 65–69 (and rising), 15 percent for the 70–74, and 6 percent for the 75+ group (Current Population Survey data). Hence the effective retirement age of the US S&E workforce is not that different from the US workforce as a whole.

43. See, however, National Academy of Sciences (2007) for an excellent blueprint on these much-needed reforms.

**Figure 1.8 Individuals in US labor force with S&E or S&E-related highest degrees, 2003**



Source: National Science Foundation, Science and Technology Indicators, 2006, table 3.13.

migration policies must increasingly focus on retaining US-trained S&E talent in the US workforce and must also remain generally open for continued inflows of foreign-trained S&E workers.

## Global High-Skilled Talent: An Increasingly Sought After Resource

International migration can be roughly split into six groups: (1) family-related (through reunions and marriages), (2) humanitarian (typically refugees from United Nations quotas or asylum seekers), (3) employment-related (permanent), (4) employment-related (temporary), (5) student, and (6) illegal. The categories of family-related, humanitarian, and illegal immigrants are of limited interest here, as their high-skilled component is usually limited.<sup>44</sup> The student category is almost exclusively by definition

44. As a clear trend exists for the highly skilled to marry highly skilled, there is a possible high-skilled component here, but for the purposes of this analysis, it can be ignored. Passell (2007, table 2) presents data showing that 17 percent of unauthorized immigrants, or 1.3 million, in the United States in 2005 had achieved at least a bachelor's degree. Many in this group likely are individuals admitted on a high-skilled temporary visa like the H-1B or F-1 student visa who have remained in the United States after their visa expiration. This is a significant number, but many of these unauthorized but high-skilled immigrants

made up of high-skilled immigrants, while both permanent and temporary employment migration have high- and low-skilled components. As can be seen in figure 1.9 (which, however, does not include data on illegal immigrants), in 2005 US permanent immigration policy was far less oriented toward employment than those of other OECD countries. Only one-tenth of new permanent immigrants in the United States in 2005 arrived directly for employment-related reasons, compared with more than twice that in Canada, three times that in Australia and New Zealand, and more than four times that share in the United Kingdom and several other European countries.

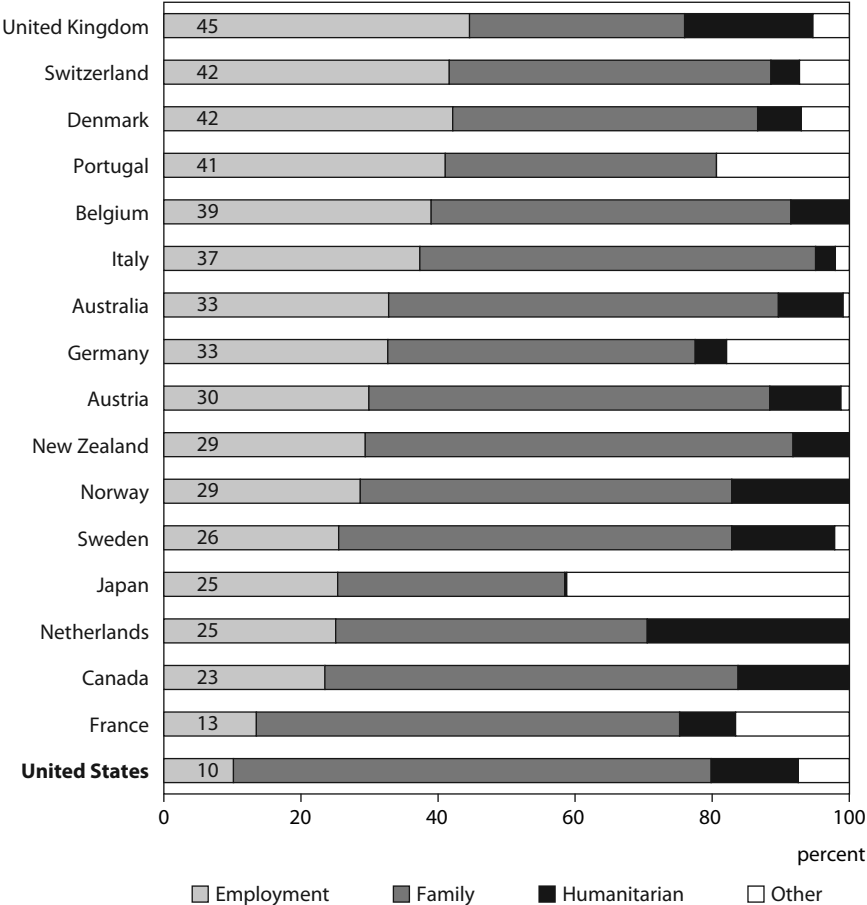
Rather, the overwhelming majority of permanent US immigration is—as explicitly stipulated by US immigration law—family-oriented. Given this overwhelming dominance of family-related immigration in total US immigration numbers, it is striking that the National Science Foundation (2007) finds that of all US immigrants with an S&E education (about 3.4 million) in 2003, only 37 percent arrived for family reasons; the number declines to 27.5 percent for S&E immigrants who arrived after 1994. Moreover, these numbers are skewed by the arrival of immigrants younger than 18 years at the time of first entry who subsequently went on to pursue S&E education in the United States. Among S&E-related immigrants with a master's degree, the share of family-related immigration drops to 30 percent, while among S&E doctoral degree holders, it is merely 16 percent. In other words, despite dominating total US immigration, family is a far less important issue when it comes to attracting S&E-educated foreigners. As other OECD countries increasingly move toward policies of “managed”—i.e., employment-oriented—immigration, this continued focus of US immigration policy on family seems likely to increasingly put the country at a disadvantage relative to other rich countries in attracting high-skilled workers from third countries, because high-skilled workers are less numerous among family-based immigrant groups.

Training foreign high-skilled workers locally is the easiest way to attract them into a country's workforce. Among international students, the United States remains by a substantial margin the largest destination country, although its share of global foreign students dropped from 25.3 percent in 2000 to 21.6 percent in 2004 (Balatova 2007). Other Anglo-Saxon countries have long competed with US universities for foreign students, but today many non-English-speaking countries, particularly in northern Europe, also offer most S&E courses in English—the globally dominant academic language today—to attract more nonnative students.

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seem unlikely to take up jobs in occupations where they can fully utilize their high-skilled capabilities. As such, they seem far more likely to take up lower-skilled jobs for which they are therefore likely significantly overqualified. Their number notwithstanding, it remains pertinent to not take them into account in this analysis.

**Figure 1.9 International permanent migration by category of entry, selected OECD countries, 2005 (percent of total inflows)**



OECD = Organization for Economic Cooperation and Development

Source: OECD (2007c).

Equally important, more countries are now emulating the US policy of offering foreign students an optional one-year work permit upon graduation<sup>45</sup> to entice them to stay. Australia has since 1999 made it relatively easier for foreigners with local degrees to obtain permanent residency via its points-based system, while in 2006 Canada eased the restriction of

45. In the United States, this system is known as optional practical training (OPT) and is available once to all foreign graduates from US universities. See, for instance, the page on Applying for F-1 Optional Practical Training at [www.oiss.yale.edu](http://www.oiss.yale.edu) for more information.

off-campus work for graduate students and in 2005 made it possible for them to stay for up to two years after graduation.<sup>46</sup> In May 2007 the United Kingdom expanded its year-long optional work visa program for graduates from just S&E fields (since 2004) to cover all bachelor's and graduate degree recipients.<sup>47</sup> In 2007 France introduced its new "first professional experience option," which grants foreign students in degree/diploma tracks the option of a six-month renewable visa to search for and accept employment in France (Murphy 2006). Even the usually highly immigration-resistant German government announced in August 2007 that foreign students who finished their degree in Germany (of which many are in science, technology, and engineering) would be eligible for a three-year work permit upon receiving a job offer.<sup>48</sup> Similar initiatives have also recently been implemented in other EU countries, so the United States as the "market leader" is clearly facing rapidly intensifying competition for foreign students as workforce entrants.<sup>49</sup>

The traditional Anglo-Saxon immigration destination countries of Australia, Canada, New Zealand, and the United Kingdom for a long time have had explicitly skills-oriented immigration policies in place, focusing on granting access to foreigners possessing an adequate number of "skills points."<sup>50</sup> However, as laid out in OECD (2006b and 2007c), and illustrated in figure 1.10, more OECD countries are putting in place immigration systems intended to "actively manage" national immigration, rather than letting it be driven by family-related and humanitarian considerations. Figure 1.10 shows that traditionally other Anglo-Saxon countries have had a higher share of highly educated immigrants than the United States (about 25 percent). In recent years, however, more European countries have surpassed the US share. Even notoriously immigration-resistant Japan in 2006 changed its Immigration Control and Refugee Recognition Act to facilitate immigration of researchers and engineers (OECD 2007c, 98f).

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46. See Citizenship and Immigration Canada press release, Canada's New Government to Extend Off-Campus Work Program to More International Students, December 14, 2006, available at [www.cic.gc.ca](http://www.cic.gc.ca); see also the web page on "Studying in Canada: Work Permits for Students" on the same website.

47. See UK Department for Children, Schools and Families, press notice, New International Graduates Scheme—Rammell, March 28, 2007, available at [www.dfes.gov.uk](http://www.dfes.gov.uk).

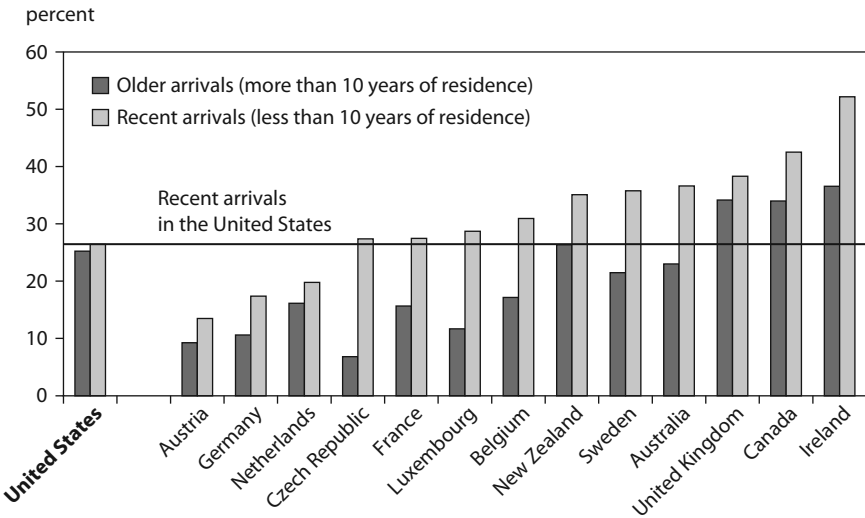
48. See "Germany Softens Restrictions of Central and Eastern European Workers," Euractiv.com, August 27, 2007, [www.euractiv.com](http://www.euractiv.com).

49. This issue has been explored in greater detail in National Academy of Sciences (2005). Lowell (2007) shows that the inflow of skilled migrants to more developed countries rose rapidly during the 1990s and that European countries increased their share of the increasing total during this period from 20 percent in 1990 to 23 percent in 2000.

50. For a summary description of the Australian high-skilled immigration points system, see White (2007); for Canada, see Clark (2007); and for the United Kingdom, see Feikert (2007). Chapter 3 further discusses these points systems.



**Figure 1.10 Share of immigrant population 15 years and older with at least tertiary education, circa 2000**



Source: OECD Foreign-born and Expatriates Database.

Managed migration policies invariably mean policies aimed at attracting more high-skilled workers while restricting access to lower-skilled ones. General exceptions are usually made only when it comes to temporary workers in the agricultural sector. The international trend indicating increased competition for high-skilled foreign labor is evident to the degree that similar immigration measures can also be identified among middle-income countries, such as recent EU members and Mexico (OECD 2007c, 96). Indeed, even at the supranational EU level, there are, at the time of this writing, firm signs that change is in the air (and Europe clearly takes inspiration from existing US immigration laws). EU Justice Commissioner Franco Frattini in mid-September 2007 announced that he would shortly propose creating an EU-wide “blue card,”<sup>51</sup> which would provide non-EU skilled workers temporary EU-wide work permits.<sup>52</sup>

Developing countries like China and India, traditionally the two largest sources in numerical terms of high-skilled immigrants,<sup>53</sup> are starting to

51. Blue is of course the color of the EU flag.

52. See “EU to Propose Blue Card for Skilled Workers,” *EU Observer*, September 14, 2007, <http://euobserver.com>.

53. High-skilled emigrants from China and India have a share of only a few percent in their domestic high-skilled workforces. Therefore the risk of serious brain drain from these

preempt possible future skill shortages as they themselves experience high economic growth. As a result of recent data that show that only a quarter of the more than 1 million Chinese students who went overseas to study from 1978 to 2006 returned to China (Chinese Academy of Social Sciences 2007), the Chinese government in March 2007 issued new guidelines for “green passage” of acclaimed overseas Chinese scientists, engineers, and executives willing to return to China. This eased passage would include such perks as guaranteed university spots for the children of returnees, exemption from the Chinese household residence registration (*hokou*) and tax preferences.<sup>54</sup> The new policy is aimed at luring back up to 200,000 such overseas Chinese by 2010, which is on top of a 50 percent increase in the number of returnees from 20,000 to 30,000 annually between 2003 and 2005. Should these new Chinese policies prove successful, the United States faces the largest potential adverse impact because it has been the traditional destination of most high-skilled Chinese immigrants.

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countries is limited. This, however, is not the case for smaller countries particularly in Africa and the Caribbean: Data from the OECD Foreign-born and Expatriates Database show that high-skilled emigrants from these countries make up almost three-quarters of the domestic high-skilled workforce, and hence brain drain concerns are justified.

54. “The Turning Tide of Overseas Chinese,” *China Daily*, May 30, 2007; “China Hit by Brain Drain, Report Says,” *China Daily*, June 1, 2007.

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## Current US High-Skilled Immigration System

This chapter briefly describes how the present US high-skilled immigration system operates and who the main beneficiaries are. However, it is crucial to first highlight a very important yet frequently ignored technical feature that concerns all data on employment-related visa issuance. When linking any such visa data with labor-market outcomes, it must be kept in mind that visa data are invariably “gross” data. As such, visa data cannot be directly related to developments in the net job data, which include the vast majority of regularly issued official labor-market statistics.<sup>1</sup> Data on employment-related visas can instead be said to most closely resemble gross data on job openings, which are available only from the Bureau of Labor Statistics (BLS) in relative aggregate categories.<sup>2</sup> No corresponding data are available from any source on the number of immigrants who lose their jobs—i.e., visa-related gross job destructions.

The US immigration system distinguishes between permanent and temporary high-skilled immigration.

### Permanent High-Skilled Immigration

Every year since 2000 approximately 1 million aliens have obtained legal permanent resident (LPR) status in America.<sup>3</sup> The majority, as mentioned in the previous chapter, are family-sponsored immigrants. But under the

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1. See Kirkegaard (2005) for an elaborate treatment of this issue.

2. Data from the Bureau of Labor Statistics, Business Employment Dynamics Program, available at [www.bls.gov/bdm/home.htm](http://www.bls.gov/bdm/home.htm).

3. See Department of Homeland Security data at [www.dhs.gov](http://www.dhs.gov).

Immigration and Nationality Act of 1990, a total of 140,000 employment-based immigrant visas can be allocated each fiscal year—from October 1 to September 30—for workers and their spouses and children.<sup>4</sup> Compared with the annual 65,000 congressional cap on H-1B visas, for instance, this number is quite large, but it is not immediately clear how many of these 140,000 are workers and how many are dependents (spouses or children only). Further, not all of the 140,000 eligible for an employment-based immigrant visa are high-skilled because needed unskilled workers may also qualify.

More important, however, from the perspective of measuring the inflow through this channel of foreign high-skilled workers to the United States, one must distinguish between “new arrivals” who got their employment-based green card (LPR status) abroad and individuals going through an “adjustment of status”—i.e., changing from a temporary (non-immigrant) visa status to LPR status—while already inside the United States. The “adjustment of status” channel does not necessarily imply that a new high-skilled worker has been added to the US workforce but rather that one who is already part of the workforce here or perhaps a graduating foreign student is allowed to remain permanently. About two-thirds of the total of about 1 million new individuals in LPR status each year go through an adjustment in status. But as can be seen in figure 2.1, the share of high-skilled employment-based immigrants who adjust their status here has been significantly higher at about 80 percent over the last decade and rose to more than 90 percent in 2005 and 2006. This trend is most pronounced among those in the highest-skilled E-1 and E-2 categories.

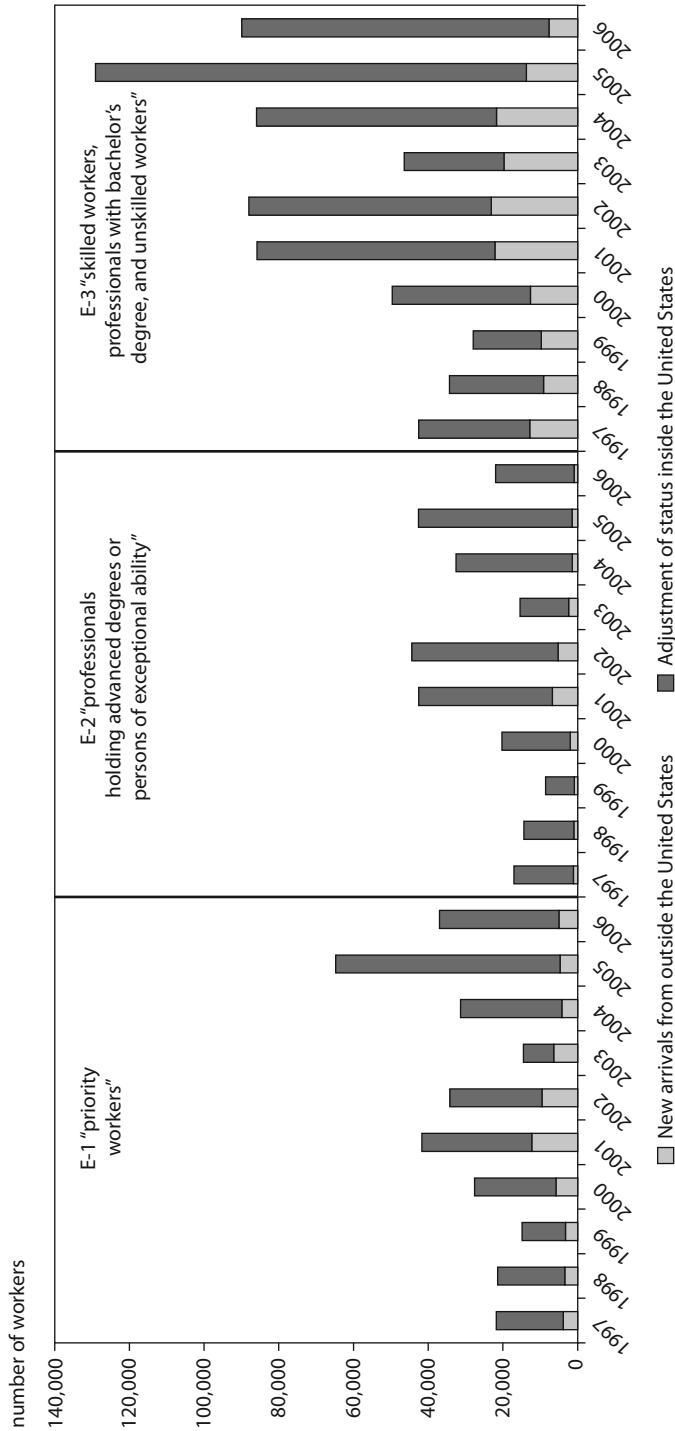
While the extraordinarily large number of adjustments in status in recent years has been linked to temporary changes in US immigration laws,<sup>5</sup> it is nonetheless evident that the green card system, rather than being a major channel for bringing new high-skilled workers to the United States,

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4. These 140,000 visas are split into five categories: E-1, E-2, E-3, E-4, and E-5. Different rules concerning labor certification, occupations, and skills govern each category. For more information, see the Department of State website at <http://travel.state.gov>. For the purposes of this policy analysis, only E-1 (priority workers), E-2 (professionals holding advanced degrees or persons of exceptional ability), and E-3 (skilled workers, professionals with a bachelor's degree, and unskilled workers) will be considered high-skilled. The E-3 (the largest) category also includes unskilled workers, hence the data total presented here for skilled workers has an upward bias.

5. The American Competitiveness in the 21st Century Act of 2000 allowed for 130,137 unused employment-based visas from 1999 and 2000 to be made available to E-1, E-2, and E-3 preference employment-based immigrants. Approximately 94,000 of these were used in 2005. The Real ID Act of 2005 further allowed for the recapture of 50,000 unused employment-based visas from 2001 to 2004; 5,125 of these were used in 2005 and 33,341 in 2006. Note also that the annual 140,000 limit may be topped up with any unused family-sponsored visas in the previous fiscal year. As a result, the 140,000 limit is hardly set in stone. See Office of Immigration Statistics (2006, 2007).

**Figure 2.1 High-skilled employment-based legal permanent resident flow, FY1997–FY2006**



Note: "New arrivals to the United States" equals number of employment-based immigrant visas issued at overseas US consular offices. Data include workers, spouses, and dependents.

Sources: US Department of State, Bureau of Consular Affairs, *Reports of the Visa Office, various years*; US Department of Homeland Security, *Yearbooks of Immigration Statistics, various years*.

functions overwhelmingly as a mechanism to ensure that those already legally employed in other visa categories remain in the US workforce. As such, with employment-based green card holders making up only a small part of new foreign entrants to the US workforce, the high-skilled green card program is intricately linked to the primary gateway through which high-skilled workers enter the United States, namely the temporary high-skilled work visa programs (see next section). If reform of either the high-skilled green card program or the high-skilled temporary visa programs is to succeed, then policymakers must acknowledge their symbiotic link. Reform of US high-skilled immigration should, therefore, encompass both permanent and temporary immigration.

The overwhelming use of the LPR system for adjustment of status gives rise to an additional major constraint for individuals already inside the United States. Section 202 of the Immigration and Nationality Act stipulates that the per-country limit for all family and employment-based immigrant visas is 7.1 percent of the annual total, or 25,620.<sup>6</sup> This per-country numerical limit is the reason why citizens of some countries (notably India and China) face oversubscribed categories and hence a very lengthy application process.

Two agencies are involved in the immigrant visa process: the Department of Homeland Security's US Citizenship and Immigration Service (USCIS),<sup>7</sup> which processes visa applications, and the Department of State, which issues the visas and is responsible for maintaining the limits (i.e., keeping track of the number of visas issued). The State Department publishes its count and visa availability each month in its *Visa Bulletin*, which is released two weeks before the first of every month. The USCIS defines the process for issuing green cards and follows the monthly *Visa Bulletins* in determining when to accept applications for adjustment of status.

Eligible foreign nationals in the United States can adjust their status to LPR—in other words, submit their “final” green card applications—when their priority or cut-off date (i.e., place in line) is current according to the *Visa Bulletin*. These dates vary among employment categories and nationalities. For instance, in June 2007 cut-off dates were current for all but four countries, China, India, Mexico, and the Philippines. These dates in June 2007 for E-2 applicants from China and India were January 2006 and April 2004, respectively, while for E-3 applicants the date was June 2003 for both countries as well as Mexico and June 2005 for the Philippines.<sup>8</sup> This means that for Indian E-2 applicants, for instance, only those applications filed

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6. The limit for dependents is 2 percent, or 7,320.

7. On March 1, 2003, functions of the US Immigration and Naturalization Service (INS) transitioned to the USCIS.

8. No cut-off date existed for E-1 priority workers in June 2007. See Department of State, *Visa Bulletin for June 2007*, available at <http://travel.state.gov>.

more than three years ago would in June 2007 start being processed in the current fiscal year.

The huge pent-up demand for LPR status among high-skilled workers already inside and employed in the United States is amply illustrated by the administrative upheaval that rattled this system in July and August 2007. In its initial *Visa Bulletin for July 2007* (issued on June 12, 2007), the Department of State announced that all employment-based green card categories, except the third “other workers” category, would be current in July 2007 and removed the hitherto implemented cut-off dates for Indian, Chinese, Mexican, and Filipino high-skilled workers. This decision allowed eligible applicants in all employment categories, regardless of nationality and cut-off dates, to apply for adjustment of status in July.<sup>9</sup>

The State Department made this announcement because it saw many unused visa numbers as the end of FY2007 (September 30) rapidly approached. In past years, many State Department–allocated visa numbers were never used and thus lost because the USCIS, plagued by administrative delays, did not manage to process enough applications to fully use the annual quota. Not wishing to “waste” large numbers of visas this year, the State department intended to front-load visa numbers to allow a large number of applicants to file for adjustment.<sup>10</sup>

This announcement from the State Department evidently “surprised” the USCIS. Realizing that it would not be able to act on so many applications in such a short span of time, it announced a series of changes to the application process and suspended services such as premium processing of immigrant visa petitions (form I-140).<sup>11</sup> Through these tactics, the agency hoped to slow the submission of applications in July.

However, two weeks later, on July 2, 2007—the day the new State Department announcement would have gone into effect—the department reversed its decision, announcing that visa numbers for all employment categories, regardless of nationality, would be unavailable until October 1, 2007, start of the next fiscal year. The department cited the sudden back-

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9. See Department of State, *Visa Bulletin for July 2007*, available at <http://travel.state.gov>.

10. See section E in the *Visa Bulletin for July 2007*, Department of State, available at <http://travel.state.gov>.

11. See USCIS Update: USCIS Announces Temporary Suspension of Premium Processing Service for Form I-140, Immigrant Petition for Alien Worker, available at [www.uscis.gov](http://www.uscis.gov). Premium processing allows petitioners, attorneys, or other representatives to pay an extra \$1,000 fee and be assured of a completed process within 15 calendar days; see “How Do I Use the Premium Processing Service?” USCIS, [www.uscis.gov](http://www.uscis.gov). Given the importance of this decision for the petitioners involved, it should be evident that this fee has clear similarities to a traditional “system greasing” bribe, usually paid to government officials in corrupt countries. As such, the premium processing system is not unlike the US political campaign contribution rules in putting an official, institutional, legal façade to what elsewhere is condemned as corruption.

log reduction efforts of the USCIS as the reason behind the reversal of the decision. The USCIS had apparently used up almost 60,000 employment-based visa numbers in June, thus exhausting all numbers available to these categories under the FY2007 annual numerical limit. The same day the USCIS announced that it was “rejecting applications to adjust status filed by aliens whose priority dates are not current under the revised *July Visa Bulletin*.”<sup>12</sup> This announcement left sponsoring US employers and applicants wondering whose dates were current in July and what would happen to rejected applications.

Following a public outcry<sup>13</sup> and a rebuke from the chairwoman of the House Immigration Subcommittee,<sup>14</sup> in mid-July 2007, the USCIS and the Department of State reversed themselves again and announced that the initial *Visa Bulletin of July 2007* would hold, thus allowing all eligible applicants, regardless of nationality and cut-off dates, to file their adjustment of status applications no later than August 17, 2007.<sup>15</sup> According to its preliminary estimates, the USCIS had—during the one-month “window of opportunity” for eligible applicants—received more than 300,000 applications for LPR status from high-skilled workers. Compare this with an average of just above 50,000 applications per month earlier in 2007. Evidently, plenty of high-skilled foreign workers already employed in the United States wish to stay permanently.

The cut-off dates for Chinese, Indian, and Filipino high-skilled workers were reimposed on August 17, 2007. So those who missed the “window of opportunity” will now have to wait for years to even submit their final applications. And those who did submit will have to wait for several months or even years to receive the green card because of the high volume of applications the USCIS received in July–August 2007. Such long, fluctuating, and arbitrary wait times will invariably force high-skilled workers already employed in the United States as well as graduating students to leave the country as they graduate from universities or as their temporary work permits run out. In other words, current bottlenecks in the LPR system may push US-trained graduates or already employed high-skilled workers, especially from the countries mentioned above, out of the US workforce.

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12. See Department of State, Update on July Visa Availability (revised *July Visa Bulletin*), available at <http://travel.state.gov>; and USCIS Update: USCIS Announces Update on Employment-Based Adjustment of Status Processing, available at [www.uscis.gov](http://www.uscis.gov).

13. See Moira Herbst, “The Gandhi Protests Pay Off,” *BusinessWeek*, July 17, 2007.

14. See “US Agency Is Swamped by Requests for Visas,” *New York Times*, August 18, 2007 and the website of Congresswoman Zoe Lofgren at <http://lofgren.house.gov>.

15. See USCIS Update: USCIS Announces Revised Processing Procedures for Adjustment of Status Applications, available at [www.uscis.gov](http://www.uscis.gov).



## Temporary High-Skilled Immigration

The United States offers two main temporary visas for employment: L-1 for intracompany transferees (in managerial, executive, or specialty knowledge positions)<sup>16</sup> and H-1B, which is an employer-sponsored visa for “specialty occupation” workers.<sup>17</sup>

### L-1 Visa Program

Few data are available on a regular basis from official sources on the L-1 visa category and on the characteristics of the foreign nationals entering the US workforce on such visas. Figure 2.2 shows the issuance of L-1 visas at US consular offices between fiscal years 1996 and 2006. While it is technically possible to adjust visa status into L-1 while inside the United States in a manner similar to the LPR system described above, the transfer requirement of the L-1 visa makes it likely that the numbers in figure 2.2 for L-1 issuance outside the United States will include the overwhelming majority of L-1 recipients inside the United States.

No numerical quotas exist for L-1 visas, and their issuance—assuming unchanged acceptance criteria over time<sup>18</sup>—should therefore broadly reflect the desire of multinational companies to transfer relevant high-skilled employees to the United States. Given the ongoing global integration of the US economy, it is not surprising that the overall issuance of L-1 visas has been rising in the last decade (figure 2.2). It is noteworthy though that Indian nationals have accounted for essentially the entire increase in L-1 visa issuance since 2000, while issuance to citizens of the rest of the world has remained flat. Given that L-1 issuance to Chinese nationals has hardly budged between 1996 and 2006, this increase in issuance to Indian nationals can scarcely be attributed solely to the ongoing global integration of

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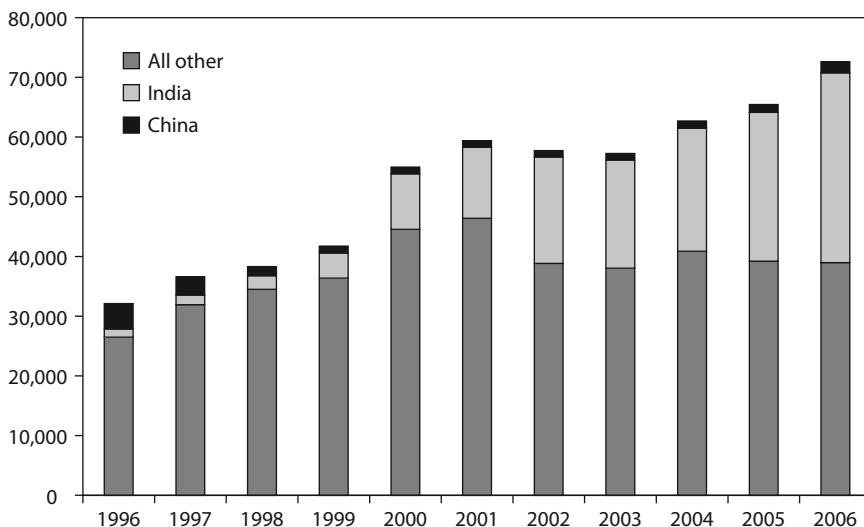
16. The L-1 visa category applies to intracompany transferees who, within the three preceding years, have been employed abroad continuously for one year and who will be employed by a branch, parent, affiliate, or subsidiary of that same employer in the United States in a managerial, executive, or specialized knowledge capacity. It is valid for up to 7 years (5 years for specialized knowledge capacity). No labor certification is necessary. See classifications of temporary workers at <http://travel.state.gov>.

17. The H-1B visa category applies to persons in a specialty occupation that requires the theoretical and practical application of a body of highly specialized knowledge requiring completion of a specific course of higher education, generally the equivalent of a bachelor's degree. This visa classification requires a labor attestation issued by the Department of Labor.

18. The legal criteria for the L-1 visa category have not changed substantially over the period shown in figure 2.2. However, a number of changes concerning worksite practices and outsourcing were enacted as a result of new rules attached to the Omnibus Appropriations Act of FY2005. See USCIS press release, USCIS Implements L-1 Visa Reform Act of 2004, June 23, 2005, at [www.uscis.gov](http://www.uscis.gov).

**Figure 2.2 Issuance of L-1 visas at US consular offices, FY1996–FY2006**

number of visas



Source: US Department of State, Bureau of Consular Affairs (2000 to 2006).

the Indian economy.<sup>19</sup> It is therefore clear that two simultaneous trends in L-1 visa issuance have existed in recent years: rapid increases concerning Indian nationals and stability concerning citizens of the rest of the world.

In June 2007 the offices of US Senators Richard J. Durbin and Charles Grassley published a specially requested USCIS list of companies that used the L-1 visa in fiscal years 2005 and 2006.<sup>20</sup> The full list for 2006 consists of approximately 18,000 companies, the top 25 of which are listed in table 2.1.

Considering the dearth of and obvious public interest in precise official data concerning the use of US high-skilled visa programs, particularly L-1 and H-1B (see below), it is both remarkable and extremely unfortunate that a special bipartisan request by two US senators is required for such highly relevant data to be made public. Certainly, the public debate over

19. This must be the conclusion, even when one allows for the fact that India's economic expansion beyond its borders has been led to a far larger degree by private-sector companies and foreign acquisitions (especially in Europe, with companies like Mittal Steel Company and Tata Steel taking over Arcelor and Corus, respectively).

20. See Office of US Senator Charles Grassley press release, Grassley and Durbin Release New Information on L Visas: List of Companies Using the L Visa, June 26, 2007, available at <http://grassley.senate.gov>.

**Table 2.1 Top 25 L-1 employers, FY2006**

Rank	Company	Sector	Home country	Number of visas
1	Tata Consulting Systems	IT services/software	India	5,408
2	Cognizant Technology Solutions	IT services/software	India	1,888
3	Wipro Ltd.	IT services/software	India	1,187
4	IBM	IT services/software	United States	614
5	Hewlett-Packard	IT hardware	United States	417
6	Satyam Computer Services	IT services/software	India	336
7	Intel Corporation	Semiconductors	United States	314
8	Caritor, Inc.	IT services/software	United States	280
9	Ernst & Young	Business services	United States	249
10	HCL Technologies	IT services/software	India	244
11	Infosys Technologies, Inc.	IT services/software	India	235
12	Patni Computer Systems, Inc.	IT services/software	India	221
13	Schlumberger	Oil services	France	198
14	Syntel	IT services/software	United States	197
15	M&E Group, Inc.	n.a.	n.a.	194
16	Exxon-Mobil	Oil	United States	187
17	Kanbay, Inc.	IT services/software	India	178
18	Halliburton	Oil services	United States	157
19	PriceWaterhouse Coopers	Business services	United States	152
20	Oracle, Inc.	IT hardware	United States	148
21	Nokia	Mobile telephony	Finland	141
22	Microsoft	IT services/software	United States	133
23	Perot Systems	IT services/software	United States	121
24	Deloitte	Business services	United States	112
25	HSBC	Financial services	United Kingdom	103

*(table continues next page)*

high-skilled immigration in the United States would benefit tremendously from such illuminating data if they were published regularly by relevant US immigration authorities. There seem to be no plausible reasons for authorities to not regularly publish such high-skilled immigration data.

Table 2.1 shows that in FY2006, the top 25 users of the L-1 visa program overwhelmingly were Indian information technology (IT) services and software companies, which accounted for approximately three-quarters

**Table 2.1 Top 25 L-1 employers, FY2006** *(continued)*

<b>Grouping</b>	<b>Share (percent)</b>	<b>Number of visas</b>
Total top 25		13,414
Total for ~18,000 companies on list		~49,200
Top 25 share of total	27	
India top 25	72	9,697
US/other top 25	28	3,717
IT services top 25	82	11,042
Other sectors top 25	18	2,372
Share of total companies with five or fewer L-1 visa petitions	~95	

n.a. = not available

Note: The source of the data in this table is a comprehensive list of companies using the L-1 visa program in FY2006. The list contains numerous misspellings and multiple entries for different legal entities that are part of the same company. Hence the precise numbers attached to each company must be viewed with caution. This data uncertainty, however, is too small to affect the conclusions drawn from these data.

Source: Office of US Senator Charles Grassley press release, Grassley and Durbin Release New Information on L Visas: List of Companies Using the L Visa, June 26, 2007, available at <http://grassley.senate.gov>; author's calculations.

of the filings among this group and about 20 percent of the total number of L-1 petitions. Indeed, it can be seen in table 2.1 that the Indian companies are concentrated at the very top, occupying seven of the top 12 spots, while being absent from the lower half of table 2.1. Also, Indian companies have a negligible presence among the rest of the approximately 18,000 companies that in FY2006 used the L-1 program, 95 percent of which requested only five or fewer L-1 visas per company. Due to the different data sources in question, it is not possible to positively conclude that L-1 visas requested by Indian IT services companies go to Indians. Yet, it is nonetheless overwhelmingly likely that the small number of Indian IT services companies listed in table 2.1 account for the vast majority of the rise in overall Indian use of the L-1 visa program (figure 2.2).

While no long time-series data are available for company use of the L-1 visa program,<sup>21</sup> the dual trend in this program indicates rising use of such visas by a limited number of intense users from the Indian IT services industry and stable and diverse use among a very large group of multinational companies from different economic sectors.

21. The data published by Senators Grassley's and Durbin's offices do, however, show very similar levels for the top L-1 users in fiscal years 2005 and 2006.

## H-1B Visa Program

Available data on the H-1B program, especially on visa issuance and characteristics of recipients, are relatively more detailed than those available for L-1 visas. Table 2.2 shows select data for the last six years, with more detail available in table A.2 in the statistical appendix. Box 2.1 estimates the potential number of H-1B visa holders inside the United States at a given point in time.

Table 2.2 shows data on the characteristics of successful petitions for H-1B visas granted by the USCIS from fiscal years 2000 to 2005 (latest available). The H-1B visa is initially valid for three years, with a three-year extension available. The data are therefore split into two categories: initial employment (first three-year period) and continuing employment (second three-year period). This section focuses on petitions granted for initial employment.

Several things are clear in table 2.2: First it is immediately clear that the number of actual H-1B petitions granted by the USCIS and the congressional cap on H-1B visas of 65,000 are almost wholly unrelated. The total number of H-1B petitions granted not only is much higher than the congressional cap but also actually rose by more than 70,000 from FY2003 to FY2004, despite the fact that the cap was reduced from 195,000 in FY2003 to 65,000 in FY2004. The reason for this seeming discrepancy is not visa fraud on a massive scale, but rather the large number of H-1B petitions that by congressional decision is exempt from being counted toward the cap of 65,000. These exceptions include all petitions granted for continuing employment, as well as all petitions granted to employers in the educational, nonprofit, research, and medical sectors (see below). Any notion that the congressional cap does, or was ever intended by the US Congress to, function as a serious regulatory instrument for the number of H-1B visas granted to foreign workers must therefore be dismissed.

Second, the total number of H-1B petitions granted fluctuates quite significantly from year to year. After peaking in FY2001, the total number dropped by about 40 percent—about 135,000—in FY2002 and was fairly flat through FY2003 before rising substantially (and even exceeding the congressional cap) by more than 70,000 in FY2004. Unsurprisingly, the majority of this fluctuation is found among petitions granted for initial employment, but some of the FY2004 spike was due to the rise in petitions for continuing employment (up more than 40,000 from FY2003)—a “three-year echo” of the more than 200,000 petitions granted for initial employment during the peak year of FY2001.

As in the LPR system, a distinction should be made between H-1B petitions granted to individuals outside the United States at the time of filing and individuals inside the United States at the time of the employer filing on their behalf. The latter would be a functional equivalent to adjustment

**Table 2.2 H-1B petitions granted by the USCIS, initial and continuing employment, by selected characteristics, FY2000–FY2005**

Line	Characteristic	FY2000
	H-1B cap legislated by Congress	115,000
1	Total number of H-1B petitions granted by USCIS	257,640
2	Of which: number of H-1B petitions granted, for initial employment	136,787
3	Of which: aliens were outside the United States at the time of employer petition	75,785
4	Of which: aliens were inside the United States at the time of employer petition	61,002
5	Of which: were from India	60,757
5a	Of which: were not from India	76,030
6	Of which: were from China	12,333
7	Of which: started working in computer-related occupations	74,551
7a	Of which: did not start working in computer-related occupations	62,236
8	Of which: started working in IT services industry	n.a.
8a	Of which: did not start working in IT services industry	n.a.
9	Of which: number of H-1B petitions granted for continuing employment	120,853
10	Of which: were from India	63,940
11	Of which: were from China	10,237
12	Of which: continued employment in computer-related occupations	73,875
13	Of which: continued employment in IT services industry	n.a.
14	Fiscal year average unemployment rate for US workers aged 16 and above (percent) <sup>b</sup>	4.0
15	Fiscal year average unemployment rate for computer programmers (percent) <sup>b</sup>	2.3

n.a. = not available

USCIS = US Citizenship and Immigration Service

a. Includes 20,000 H-1Bs for foreign graduates from US universities.

b. Estimated as the average of Q4 (previous year) and Q3 (current year) from Bureau of Labor Statistics and Census Bureau, Current Population Survey (CPS) release (16 years and above) and quarterly data on employed and experienced unemployed persons by detailed occupation and class of worker, table 3 from the CPS (computer programmers).

Note: The shaded rows in the table denote top country of origin, top occupation, and top industry.

<b>FY2001</b>	<b>FY2002</b>	<b>FY2003</b>	<b>FY2004</b>	<b>FY2005</b>	<b>Change, FY2001– FY2002</b>	<b>Change, FY2003– FY2004</b>
195,000	195,000	195,000	65,000	85,000 <sup>a</sup>		
331,206	197,537	217,340	287,418	267,131	–133,669	70,078
201,787	103,584	105,314	130,497	116,927	–98,203	25,183
115,759	36,494	41,895	60,271	54,635	–79,265	18,376
85,320	67,090	63,419	70,226	62,292	–18,230	6,807
90,668	21,066	29,269	60,062	57,349	–69,602	30,793
111,119	82,518	76,045	70,435	59,578	–28,601	–5,610
16,847	11,832	11,144	11,365	10,643	–5,015	221
110,713	25,637	28,879	56,559	52,353	–85,076	27,680
91,074	77,947	76,435	73,938	64,574	–13,127	–2,497
88,613	17,803	19,347	47,362	44,644	–70,810	28,015
113,174	85,781	85,967	83,135	72,283	–27,393	–2,832
130,127	93,953	112,026	156,921	149,932	–36,174	44,895
70,893	43,914	49,897	63,505	61,171	–26,979	13,608
10,483	7,009	8,919	14,893	13,918	–3,474	5,974
80,684	49,477	54,235	70,720	61,515	–31,207	16,485
60,071	35,814	39,323	51,182	43,550	–24,257	11,859
4.3	5.7	6.0	5.6	5.2	+ 1.4	– 0.4
2.7	6.3	6.8	6.0	2.6	+ 3.6	– 0.8

*Sources:* US Department of State, Bureau of Consular Affairs (2000 to 2006); INS (2000b, 2002a, 2002b); US Department of Homeland Security, Office of Immigration Statistics (2003b, 2004b); USCIS (2006a, 2006b). It must be emphasized that the USCIS caveats these reports on H-1B visas by stating that “very little editing has been done to the data,” and there may consequently be some errors in the data. Whether these errors are likely to be systematic cannot be discerned.

### Box 2.1 How many H-1B visa holders are there in the United States?

Estimating the number of H-1B visa recipients inside the United States at any given point in time is fraught with difficulty, as gross data are available only for the number of visa petitions granted and actual visas issued. Any estimate will therefore have to rely on assumptions concerning the departure date of the visa holder. The intuitively most sound approach seems to be to assume that an H-1B visa holder remains employed within the United States for the entire duration of the visa.

Assuming, therefore, that H-1B visa holders remain in the United States for the full three years their visa is valid and drawing on the data in table 2.2 and appendix table A. 2, one is presented with several options for estimating a total potential number of H-1B visa holders inside the United States. It is important to note that such estimates represent an upper-bound estimate. These are presented in table 2.B1.

**Table 2.B1 Total potential number of H-1B visa holders in the United States, 2001–05**

Category	2001	2002	2003	2004	2005
Total potential H-1B petitions approved	n.a.	786,383	746,083	702,295	771,889
Total potential H-1B visas issued	411,446	413,285	387,191	364,513	370,261
Total potential Indian H-1B visa holders	n.a.	351,238	305,707	267,713	321,253
Total potential H-1B visas issued to Indians	190,670	179,620	160,335	149,994	159,561
Total potential H-1B visa holders in computer-related occupations	n.a.	414,897	349,625	285,507	324,261

n.a. = not available

Sources: Table 2.2 and appendix table A.2.

If one looks first at the total number of H-1B petitions, one can see that about 750,000 foreign high-skilled workers could potentially have been legally present in the United States on H-1B status between 2002 and 2005, assuming that all approved petitions were used and everyone stayed for the entire three-year period. This upper-bound estimate equals about 1.4 to 1.5 percent of the total US high-skilled population with at least a bachelor's degree over this period.<sup>1</sup>

At the same time, however, row 2 shows that only about half as many were issued H-1B visas and could have been present from 2001 to 2005. This number excludes all

*(box continues next page)*



**Box 2.1 How many H-1B visa holders are there in the United States? (continued)**

aliens who changed their visa status to H-1B while already inside the United States and therefore is significantly lower than the actual total at any given time. As such, the true number of H-1B visas holders inside the United States lies in the range of numbers in rows 1 and 2,<sup>2</sup> or between 370,000 and 770,000 in 2005.

A similar estimation yields a number for potential Indian H-1B holders of between 160,000 and 320,000 in 2005 (rows 3 and 4). A potential 324,000 H-1B visa holders in computer-related occupations could have been present in the United States in 2005, which was 90,000 fewer than in 2002 but 40,000 more than in 2004 (row 5). No data exist for the number of H-1B visas actually issued to aliens in computer-related occupations, and no lower-bound estimate is therefore available for this category.

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1. In 2005 there were 54.7 million US residents with at least a bachelor's degree (US Census Bureau at [www.census.gov](http://www.census.gov)).

2. More sophisticated estimates can be made, for instance, by adjusting the population numbers for deaths, projected levels of emigration from the United States (i.e., early returns), and transfers to permanent US residence. See Lowell (2000). However, introducing such additional assumptions in the estimations is both beyond the scope of this policy analysis and unlikely to materially affect the results.

in status in the LPR system. All H-1B petitions granted for continuing employment must fall in this latter category, as do a little more than half of the petitions for initial employment (line 4 in table 2.2).<sup>22</sup> INS (2000b) data indicate that the majority of individuals for whom a petition for initial employment is filed while inside the United States are students adjusting their status from F-1 student visa to H-1B temporary worker. Given that the one-year optional practical training (OPT) period of legal employment is available to all F-1 students graduating from US universities for a minimal fee compared with the costs of an employer filing for an H-1B visa,<sup>23</sup> it seems reasonable to assume that many students transferring to H-1B status do so while already employed in the United States on OPT and as such do not contribute to new inflows of high-skilled workers to the US economy. However, it is certain that this group of foreign students trans-

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22. The share of petitions filed for people inside the United States was about 45 percent in 2001 and rose to 65 percent in 2002 before declining to between 50 and 55 percent in 2004–05.

23. In order for a student to enter the 12-month OPT period, he/she must pay only a \$180 fee for the employment authorization form I-765 submitted to the USCIS, compared with employer costs of up to \$5,000 for filing an application for H-1B status, as reported in Anderson (2006).

ferring to H-1B status constitutes a substantial part of the retention of foreign science and engineering (S&E) students highlighted in the previous chapter. Hence it is comforting to note that this group is relatively stable in size at about 60,000 to 70,000 and does not seem to have particularly suffered after 2001.

Moreover, while the annual extra quota of 20,000 H-1B visas made available in May 2005 to foreign graduates with a US master's or higher degree was not exhausted during the remaining five months of FY2005,<sup>24</sup> the entire quota of 20,000 visas for FY2006 was exhausted within less than four months into the fiscal year in January 2006.<sup>25</sup> The quotas in fiscal years 2007 and 2008 have also been fully used (see below).

By far the most sensitive segment of H-1B issuance is the number of petitions granted for initial employment to individuals outside the United States (line 3 in table 2.2)—in other words, to the segment that introduces new high-skilled workers to the US workforce. It declined by more than 70 percent from FY2001 to FY2002, accounting for more than 80 percent of the total decline that year, while rising more than 40 percent from FY2003 to FY2004, accounting for just under three-quarters of the total rise.

Cross-tabulations of data from different rows in table 2.2 are not available. But data on petitions for initial employment for the top two countries of origin (lines 5 and 6), top occupation (line 7), and top industry (line 8) reveal that, as in the L-1 program, Indian nationals dominate the H-1B program and that most recipients work in computer-related occupations and/or in the IT services industry. Besides, it is clear that a large part of the decline of about 80,000 from FY2001 to FY2002 in initial employment petitions originating from outside the United States is found in all three groups, namely Indian nationals, computer-related occupations, and IT services sector (second column from right). The same is true for the rise in petitions for initial employment during FY2003–FY2004 (far right column). These data thus suggest that one group of workers, namely Indians who are granted initial employment in computer-related occupations in the IT services industry while outside the United States at the time of the petition filing—a group of obvious interest in the offshoring debate—is the most irregular group of all H-1B recipients. While they make up approximately half of all petitions for initial employment, they also account for the vast majority of the fluctuation in the total number of H-1B petitions granted for initial employment.

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24. The USCIS announced at the end of June 2005 that it had received only 8,069 petitions. See USCIS press release, USCIS Announces Update Regarding New H-1B Exemptions, June 12, 2005, available at [www.uscis.gov](http://www.uscis.gov).

25. See USCIS press release, USCIS Reaches H-1B Exemption Cap for Fiscal Year 2006, January 18, 2006, available at [www.uscis.gov](http://www.uscis.gov).

At the same time, table 2.2 indicates that use of the H-1B system by employers on behalf of individuals who account for roughly the other half of petitions for initial employment (captured in lines 5a, 7a, and 8a)—i.e., those who are not Indian, not employed in computer-related occupations, or do not work in the IT services sector—is relatively stable at approximately 70,000 to 80,000 petitions per year, excluding the peak year of FY2001.

Similar to the dual trend in L-1 visas, two distinct India-related trends can be identified in the H-1B program: volatility concerning inflow of new (for initial employment) high-skilled workers from India and relative stability concerning the inflow of such workers from the non-India world. Moreover, additional data for the H-1B program indicate that the former trend is concentrated among workers in computer-related occupations and in the IT services sector.

While one should generally avoid comparing gross visa data with labor-market outcomes, it is nonetheless clear from lines 14 and 15 of table 2.2 that the volatile half of H-1B petitions for initial employment tended in both 2001–02 and 2003–04 to behave as one would theoretically expect “data on gross job openings” to behave—i.e., the number of petitions for initial employment fell drastically when US unemployment rose in 2001–02 and rose when US unemployment fell in 2003–04.<sup>26</sup> This movement is particularly pronounced when one compares the H-1B initial employment data with the unemployment rate for a key group of workers in the offshoring debate—computer programmers (see below). This group experienced a very large rise in unemployment during 2001–02, which exceeded the unemployment rate for the total economy, but in 2005 returned to essentially full employment at between just 2 and 3 percent unemployment, a level at which it has remained until the last available data for 2007Q2.

At the same time, table 2.2 clearly shows that even as the US unemployment rate among computer programmers was rising in FY2001–02, more than 25,000 new H-1B recipients entered the US workforce in computer-related occupations during that period. As no data are available for the number of foreigners on H-1B visas who exited computer-related occupations in this period, the net employment and wage impact of these movements in this occupational category cannot be immediately discerned (see chapter 3).

Data from the USCIS on the number of H-1B visa petitions granted to individual firms are not available on a regular basis.<sup>27</sup> Data for the

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26. In some respect it mirrored the experience of the total number of gross private job openings in the US economy, which peaked in 2000Q4 and started to rebound only in 2003Q4. In 2001Q2 US gross job losses for the first time since 1992 exceeded the number of gross job openings. Data from the Bureau of Labor Statistics, available at [www.bls.gov/bdm/home.htm](http://www.bls.gov/bdm/home.htm).

27. Firm-level data on H-1B foreign labor certification applications are available at the De-

1999–2000 period are available from INS (2000a), and Senators Durbin and Grassley published in June 2007 a special release of the top 200 companies in terms of H-1B recipients in 2006 based on USCIS data.<sup>28</sup> Table 2.3 shows the top 25 companies on the senators' list (full list is supplied as table A.3 in the statistical appendix)<sup>29</sup> and their home countries and business sectors.

The top 25 account for 35,829 H-1B visas granted in 2006, just below half of the total 77,851 for the top 200<sup>30</sup> (data are not yet available for the entire H-1B program for 2006). Indian IT services/software companies clearly dominate the top of the ranking, occupying 7 spots out the top 10 and 13 of the top 25 and accounting for fully two-thirds of the H-1B visas granted in the top 25 (almost 24,000), while US firms in IT services/software, education, financial services, and other sectors account for the remaining third (about 12,000 H-1B visas). These firm-level data thus corroborate the finding in table 2.2 of a substantial group of H-1B recipients from India working in computer-related occupations and the IT services sector. The lack of firm-level time-series data prevents an affirmative analysis of whether the use of the H-1B program by the top Indian IT services firms fluctuates as much as indicated in table 2.2 or whether the fluctuation in table 2.2 is accounted for by other companies recruiting Indian nationals.

Again, however, it must be emphasized that these firm-level data are of a "gross job creation" nature and do not necessarily indicate, for instance, that number one ranked Infosys increased its foreign high-skilled workforce in the United States on H-1B visas by almost 5,000 in 2006 alone. Instead, based on data from the company's filings with the Securities and Exchange Commission (SEC), table 2.4 shows that the number of H-1B visa holders in Infosys in 2006 was up by a still substantial 1,780, when accounting also for foreign workers whose visas expired and who thus subsequently exited this visa status and presumably left the United States. It should, however, be emphasized that the extensive use of a "project-based on-site delivery" model by companies like Infosys, where individual

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partment of Labor FLC database at [www.flcdatabase.com](http://www.flcdatabase.com). These data capturing "an interest in applying," however, are very different from the actual number of H-1B petitions granted by USCIS and hence should not be used to analyze visa quantities or the number of actual new foreign high-skilled immigrants entering the US labor market.

28. See Office of US Senator Charles Grassley press release, Grassley and Durbin Release New Information on L Visas, June 26, 2007, available at <http://grassley.senate.gov>.

29. The full list of 200 companies is from *InformationWeek*, May 17, 2007, based on data obtained by this news organization from the offices of the senators in question.

30. It is not clear from the statements from the offices of Senators Durbin and Grassley whether the data in table 2.3 equal all H-1B petitions granted to each company or only those for initial employment. The assumption here will be that these data incorporate all H-1B petitions granted.

**Table 2.3 Top 25 H-1B employers, 2006**

<b>Rank</b>	<b>Company</b>	<b>Sector</b>	<b>Home country</b>	<b>Number of visas</b>
1	Infosys Technologies, Ltd.	IT services/software	India	4,908
2	Wipro Ltd.	IT services/software	India	4,002
3	Microsoft Corporation	IT services/software	United States	3,117
4	Tata Consultancy Services Ltd.	IT services/software	India	3,046
5	Satyam Computer Services Ltd.	IT services/software	India	2,880
6	Cognizant Tech Solutions Corporation	IT services/software	India	2,226
7	Patni Computer Systems, Inc.	IT services/software	India	1,391
8	IBM Corporation	IT services/software	United States	1,130
9	Oracle, Inc.	IT services/software	United States	1,022
10	Larsen & Toubro Infotech Ltd.	IT services/software	India	947
11	HCL America, Inc.	IT services/software	India	910
12	Deloitte & Touche LLP	Accounting	United States	890
13	Cisco Systems, Inc.	ICT hardware	United States	828
14	Intel Corporation	Semiconductors	United States	828
15	I-Flex Solutions, Inc.	IT services/software	India	817
16	Ernst & Young LLP	Accounting	United States	774
17	Tech Mahindra Americas, Inc.	IT services/software	India	770
18	Motorola, Inc.	ICT hardware	United States	760
19	Mphasis Corporation	IT services/software	India	751
20	Deloitte Consulting LLP	Consulting	United States	665
21	Lancesoft, Inc.	IT services/software	India	645
22	New York City Public Schools	Education	United States	642
23	Accenture LLP	Consulting	United States	637
24	JPMorgan Chase & Co.	Financial services	United States	632
25	Polaris Software Lab India Ltd.	IT services/software	India	611

*(table continues next page)*

H-1B recipients work on-site with US-based clients for the duration of a given project rather than for the duration of the H-1B visa, makes estimating “true” net employment levels for high-skilled workers highly problematic.

**Table 2.3 Top 25 H-1B employers, 2006** (*continued*)

Grouping	Percent share of total visas	Total number of visas
Total top 25		35,829
Total top 200		77,851
Top 25 share of total top 200	46	
Indian top 25	67	23,904
US top 25	33	11,925
IT services/software top 25	81	29,173
Education top 25	2	642
Financial services top 25	2	632
Other sectors top 25	15	5,382
Total top 26–200		42,022
Top 26–200 share of total top 200	54	77,851
Indian top 26–200	3	1,349
US top 26–200	92	38,838
Other countries top 26–200	4	1,835
IT services/software top 26–200	28	11,966
Education top 26–200	37	15,587
Financial services top 26–200	10	4,210
Other sectors top 26–200	24	10,259

ICT = information and communication technology

Source: Marianne Kolbasuk McGee, "Who Gets H-1B Visas? Check Out This List," *Information Week*, May 17, 2007; author's calculations.

It is obvious from the tables in this chapter that a small number of Indian-based IT services companies are indeed very heavy users of the H-1B and L-1 visa programs and that the existence of these high-skilled visa programs is integral to their business in the United States.<sup>31</sup> However, it is also clear from table 2.3 that the use of the H-1B program beyond the top 25 users—i.e., among those ranked 26 to 200—was very different during 2006. This group accounts for 54 percent of the total number of H-1B visas in the top 200 (see bottom of table 2.3). Indian IT services/software companies are largely absent from this group. US educational institutions are the biggest individual sector in this group, accounting for more than

31. This fact can be easily verified by looking at the SEC filings of several Indian top 10 companies. Infosys, Wipro, Patni, and Satyam all have 20-F filings available in the EDGAR database on the SEC website, [www.sec.gov/edgar](http://www.sec.gov/edgar). Under the sections concerning risks to forward-looking statements, all these companies list "restrictions on immigration" as a factor that could affect their ability to compete for and service US-based clients, which might hamper companies' growth and adversely affect their revenues.

**Table 2.4 Infosys employees on US temporary employment visas, 2003–07**

<b>End of company fiscal year</b>	<b>Approximate number of H-1B visa holders</b>	<b>Net change from previous year</b>	<b>Approximate number of L-1 visa holders</b>	<b>Net change from previous year</b>
March 31, 2003	4,090		1,760	
March 31, 2004	3,200	–890	700	–1,060
March 31, 2005	4,350	1,150	700	0
March 31, 2006	6,130	1,780	790	90
March 31, 2007	7,100	970	650	–140

*Source:* Company Annual 20-F Filings with the Securities and Exchange Commission.

a third (37 percent) of visas granted, with largely non-Indian IT services/software accounting for 28 percent of the visas and financial services and other sectors making up the rest.

The dual India-related nature of the H-1B program found at the aggregate level is thus also explicit at the firm level: A small number of Indian IT services/software companies dominate the program in the top 25, but at the lower tiers, far more numerous US companies in a variety of sectors account for the demand for foreign high-skilled workers. The fact that these two relatively distinct groups of “customers” are using the H-1B high-skilled visa program (likely also the L-1 program) gives rise to a number of policy issues, which will be covered in the next two chapters. It is, however, erroneous to draw policy conclusions concerning the overall use and impact of the H-1B program based exclusively on the characteristics of the most intensive users at the top of table 2.3.

In summary, this chapter illustrated how the green card program for high-skilled workers is overwhelmingly a second step aimed at adjusting the status to permanent residency by already employed high-skilled workers in the United States and that high-skilled Chinese and Indian nationals face significant delays in obtaining their green cards. Second, an India-related dual trend exists in the main temporary high-skilled immigration system comprising the L-1 and H-1B programs: L-1 issuance for Indians is rising rapidly and in 2006 was dominated by a limited number of IT services companies. However, L-1 issuance is stagnant for high-skilled workers from other nationalities and generally spread over a very large number of multinational companies, the vast majority of which requested only fewer than five L-1 visas in FY2006. Detailed data for H-1B issuance show a similar dual trend, with a small number of Indian IT services/software companies among the most intensive users of the H-1B program, ahead of a far more diverse group of US companies.

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## **Welfare Trade-Off, US Software Workers, and Immigration Quotas**

This chapter first considers the broad efficiency versus equity trade-off related to high-skilled immigration and then takes an in-depth look at the labor-market situation faced by the group of US workers most affected in recent years by foreign high-skilled immigration—software workers. Finally it considers the best ways to match foreign workers with US employers and why the use of quotas in high-skilled immigration policies should be avoided.

### **Welfare Economic Efficiency Versus Equity Trade-Off**

High-skilled immigration sets itself apart from other types of migration by its explicit focus on human capital and skills. Hence it must predominantly be oriented toward generating economic growth by easing high-skilled labor shortages in America in the short term and broadly expanding the productive labor capacity in the long run. At the same time, of course, high-skilled immigration policies ought not to be blind to the rights of American workers and should strive to minimize any adverse economic impact on them. The foreign labor certification (FLC) process in US high-skilled (as well as other) immigration law seeks to achieve this latter goal.

This process is managed by the Department of Labor’s Employment and Training Administration (ETA) with the explicit aim of ensuring that “the admission of foreign workers into the United States on a permanent or temporary basis will not adversely affect the job opportunities, wages, and working conditions of U.S. workers” and “certification may be ob-



tained in cases where it can be demonstrated that there are insufficient qualified U.S. workers available and willing to perform the work at wages that meet or exceed the prevailing wage paid for the occupation in the area of intended employment.”<sup>1</sup> This policy covers only the applications in employment-based legal permanent resident (LPR) status categories E-2 and E-3 and in the H-1B program. LPR status category E-1 and the L-1 temporary visa do not require an FLC and are instead solely conditional on the applicant meeting the visa category criteria<sup>2</sup> and having a US-located job offer.

Much public discourse concerning particularly the H-1B visa has centered on whether the FLC is credible or not and by extension therefore on whether this process adequately protects US worker rights.<sup>3</sup> It is beyond the scope of this policy analysis to adequately evaluate whether or not this is legally the case with the present FLC system. On the other hand, the international trend in the degree to which other OECD governments use FLC-like “labor-market testing” in relation to high-skilled workers is clear: More OECD countries have been scaling it back in recent years. The OECD’s *International Migration Outlook 2007*, in a section illustratively titled “Towards the end of labour market testing,” notes that in the OECD countries, it has broadly been the case in recent years that

[o]n the basis of a precise evaluation of the shortages in certain branches and professions, labour market testing has been lifted for a wider range of occupations. (OECD 2007c, 97)

In other words, other OECD countries are clearly less concerned in today’s global economic environment than in previous periods about the welfare impact of high-skilled immigration on their native high-skilled workforces. Ironically, therefore, other OECD countries today are increasingly more “free traders in high-skilled people” than is the “traditional immigrant destination country” of the United States. This observation is pertinent for the efficiency-equity trade-off debate in America.

Chapter 1 established that the compositional improvement of the US labor force will slow dramatically and possibly stop entirely in the next decade as a result of the 30-year stagnation in the skill levels acquired by

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1. The process is described on the ETA website at [www.foreignlaborcert.doleta.gov](http://www.foreignlaborcert.doleta.gov).

2. The E-1 “priority worker” LPR status requires that the applicant present extensive documentation showing sustained national or international acclaim and recognition in the field of expertise. For the L-1 visa, the sponsoring company must provide proof that the applicant is hired into a US-located managerial, executive, or specialized knowledge capacity.

3. See, for instance, US House of Representatives, Subcommittee on Immigration, Citizenship, Refugees, Border Security, and International Law Oversight Hearing on “Is the Labor Department Doing Enough to Protect U.S. Workers?” June 22, 2006; GAO (2006); Miano (2007); and Hira (2007).

workforce entrants and the imminent retirement of the highly educated baby boomer generation. Meanwhile, other OECD countries continue to rapidly improve their workforce skill levels. Simply put, America in the 21st century is no longer a skill-abundant country relative to an increasing share of the rest of the world. On the efficiency side, this slowdown in US labor force skill improvement implies that for America to regain its historical status as the most skill-abundant country in the global economy, it must—as even successful education reforms will have an impact only in the long term—expand high-skilled immigration in the short to medium term. On the equity side, ironically, it implies that the labor-market situation for US high-skilled workers—i.e., those with at least a four-year college degree—will in all probability remain benign. “Getting a degree” will continue to be the ticket to a financially secure “good life” as plenty of well-paying jobs are and will be available for graduates new and old. This situation is already manifested in the unemployment rate for high-skilled US workers, which in the latest available data in 2005 was 2.3 percent (and falling relative to that for other workers),<sup>4</sup> while their wages were almost 50 percent (and rising again) higher than those of high school graduates.<sup>5</sup> Moreover, as high-skilled immigrants generally function as complements rather than substitutes to the native workforce, the wages of high-skilled Americans—unlike those of low-skilled workers—are typically not adversely affected by the increased labor-market competition from high-skilled immigrants.<sup>6</sup> (See next section on US software workers.)

In the aggregate, therefore, it seems appropriate to ask whether high-skilled American workers as a group possess a strong *prima facie* case for government protection in the form of strict labor-market testing and numerical limits on the number of high-skilled immigrants that can enter the United States. I clearly believe that they do not. Shielding high-skilled American workers from labor-market competition in today’s era of accelerating skill shortages and increased global competition for talent is simply not an appropriate area for much, if any, US government intervention.

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4. See footnote 22 in chapter 1.

5. See Economic Policy Institute, *Datazone, Wage and Compensation Trends*, table on estimated wage premium for college and high school graduates, 1973–2005, available at [www.epi.org/datazone/06/college\\_premium.pdf](http://www.epi.org/datazone/06/college_premium.pdf).

6. The degree of substitutability between immigrants and native workers will tend to be higher in lower-skilled jobs with fewer training costs and limited language, professional, institutional, and licensing requirements. Orrenius and Zavodny (2007) find that newly arrived high-skilled immigrants in professional occupations have a positive impact on natives’ wages, suggesting likely complementarities between, for instance, recently arrived high-skilled temporary workers on H-1B visas and native workers. Friedberg (2000) shows that the returns to skills for immigrants who have acquired educational and professional experience in their home countries are lower in the United States. See also CEA (2007), Ottaviano and Peri (2006), and Borjas (1999). Borjas (2003), however, finds that wages for college graduates declined 4.9 percent due to high-skilled immigration.

Hence, if existing US high-skilled immigration laws remained unchanged in the years ahead, it would represent a remarkable example of regulatory capture and successful rent-seeking strategic behavior by a high-skilled and otherwise privileged special interest group. The result would be the redistribution of economic rents<sup>7</sup> to this group, but at the expense of overall economic growth prospects of the US economy.

## Software Workers: The Most Affected High-Skilled Americans

The economics literature has generally found that high-skilled (unlike low-skilled) immigrants have no adverse effects on native workers.<sup>8</sup> A brief look at the fate of high-skilled software workers will be illustrative, as it will allow for a test of this general hypothesis on a particular group of affected high-skilled workers of obvious policy and media interest. Chapter 2 found that a large number of Indian nationals have been offered jobs in computer-related occupations in the United States in recent years, particularly through the L-1 and H-1B programs. Similarly, a great deal of anecdotal evidence on US software workers losing their jobs to Indians on high-skilled visas has been reported in the US press, as well as presented at hearings before the US Congress.<sup>9</sup> American software workers would thus seem an obvious group of high-skilled Americans adversely affected by high-skilled immigration. Indeed, given that computer-related companies and occupations dominate the L-1 and H-1B high-skilled immigration programs (chapter 2), it is implausible that US workers in any other single occupation could have been adversely affected by high-skilled immigration to the same degree. In other words, if adverse effects on native US high-skilled workers cannot be discerned among US software workers, then such adverse effects would be highly unlikely among US workers in other high-skilled occupations, which have experienced far lower inflows of foreign high-skilled workers.<sup>10</sup>

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7. The term “economic rents” is used here in its usual Ricardian sense: the difference between what a factor of production is paid and how much it would need to be paid to remain in its current use.

8. See, for instance, CEA (2007), Orrenius and Zavodny (2007), Lowell (2007), Passell (2007), Ottaviano and Peri (2005), Camota (1997), and Friedberg (2001). Borjas (2003) finds that unskilled workers are even more negatively affected by immigrants than are high-skilled workers.

9. See, for instance, testimony by John Miano before the Subcommittee on Immigration, Citizenship, Refugees, Border Security, and International Law on March 30, 2006 and June 22, 2006 or the testimony of David Huber before the same committee on March 30, 2006.

10. This statement is based only on comparing the “quantitative supply” of foreign high-skilled immigrants, which is far higher in software occupations than in others. It is possible

As tentatively alluded to in table 2.2, however—and as elaborated in this section—the actual labor-market devastation that American software workers have experienced in recent years is far from obvious, either in employment or wage terms.

As can be seen in figure 3.1,<sup>11</sup> unemployment rates for computer programmers have historically been significantly below the overall unemployment level in America. However, following the collapse of the internet bubble and the end of the Y2K mania, unemployment rose by mid-2002 to above the level for the total US economy. In late 2004, however, unemployment rates for computer programmers again fell below that of the total economy and have since 2005 been about 2 percent or about the level for all university graduates (2.3 percent in 2005). Allowing for frictional unemployment, levels close to 2 percent imply essentially full employment. As such, the aggregate data show that unemployment among computer programmers in America for the last two years has been negligible. Figure 3.1 shows a similar trend in the other major software occupation, that of software engineers,<sup>12</sup> for whom data are available only for 2000–2007: a sig-

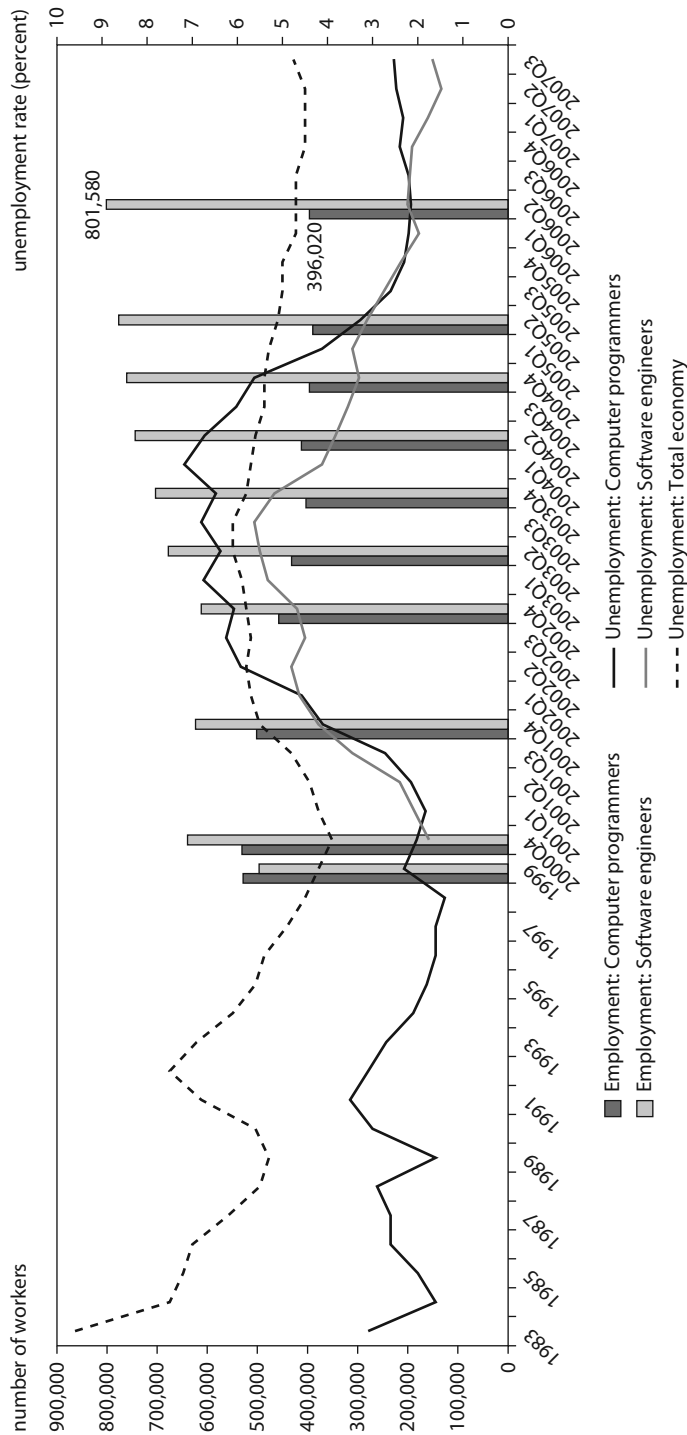
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that American-born workers in other occupations, with less job creation in recent years (or outright net job losses) than has been observed among software occupations, could be more affected by lower numbers of high-skilled foreign immigrants. However, this seems improbable given the very high numbers for high-skilled software-related immigrants and the diversity among “nonsoftware” high-skilled immigrants.

11. Figure 3.1 combines data from the National Science Foundation for computer programmer unemployment from 1983 to 1999 with more recent unemployment data from the detailed occupational tables in the Current Population Survey by the Bureau of Labor Statistics (BLS) and US Census Bureau, as well as available BLS Occupational Employment Statistics (OES) employment data from 1999 to 2007. The OES website, [www.bls.gov/oes](http://www.bls.gov/oes), lists several methodological reasons why one should be careful with using OES data as a time-series as is done in figure 3.1. However, the data presented in figure 3.1 are national employment data for all industrial sectors in only the 2000 Standard Occupational Classification and do not concern occupations in which seasonal variation is a major concern. Consequently, the methodological considerations regarding time-series use of OES data are nonmaterial for the data used here. OES data have been published at irregular intervals since 1999, but the survey data values are benchmarked to either May or November reference periods. As such, in the treatment here, OES data will be referred to as either Q2 (May data) or Q4 (November data). For more methodological detail, see technical notes for the May 2006 OES estimates at the BLS website at [www.bls.gov/oes/current/oes\\_tec.htm](http://www.bls.gov/oes/current/oes_tec.htm).

12. This policy analysis has chosen a relatively narrow definition of software workers, including only computer programmers and software engineers. This is an intentional attempt at isolating the experiences of a group of high-skilled workers who have been subject to overwhelming media interest in recent years. Further, it is an intuitively valid demarcation of software workers as the following BLS employment classification descriptions show. The BLS definition of “Computer Programmers” (SOC 15-1021) is: Convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. Develop and write computer programs to store, locate, and retrieve specific documents, data, and information. May program websites. The BLS definitions of the two “software engineers” categories, “Computer Software Engineers, Applications” (SOC 15-1031) and “Computer Software Engineers, Systems Software” (SOC 15-1032), are as fol-

Figure 3.1 US software employment and unemployment, 1983–2007



Note: Annual data for 1983–99; four-quarter lagging moving average for 2000–2007; “software engineers” includes both applications and systems software. The availability of data used in this figure has been irregular due to repeated changes by the Bureau of Labor Statistics in the survey methodology.

Sources: National Science Foundation; Bureau of Labor Statistics and Census Bureau, Current Population Survey, available at [www.bls.gov/cps](http://www.bls.gov/cps); Bureau of Labor Statistics, Occupational Employment Statistics, available at [www.bls.gov/oes](http://www.bls.gov/oes).

nificant rise after the technology bust, followed by a return to full employment by 2005. While in the constant creative destruction in the dynamic US economy, even high-skilled software workers often lose their jobs (or equally likely leave voluntarily for another) and hence do not have full job security, a 2 to 3 percent unemployment rate indicates that they have near complete employment security (see box 3.1).

Turning to software employment numbers, the bars in figure 3.1 show that at the time of the earliest available data in 1999, there were roughly the same number of computer programmers and software engineers in America, at about half a million each. During the peak year of the internet bubble in 2000, the number of US computer programmers was flat, while the number of software engineers rose by about 125,000 to a combined employment level of about 1.15 million at the peak of the bubble. Following the internet bust, US software employment declined by about 100,000 workers, mostly computer programmers, to about 1.05 million at the trough by end of 2002. During 2003, employment among software engineers rebounded strongly, while that of computer programmers continued to decline to about 400,000 by 2004, a level at which it has since remained roughly steady. Employment of software engineers in 2006Q2 (latest available) had risen to a record more than 800,000, pushing total US software employment to a new record of 1.2 million.

Recall box 2.1, which estimates that the total number of H-1B workers in computer-related occupations in the United States could have been up to 324,000 in 2005. It is important to note here that the category of computer-related occupations is significantly broader than just the two occupations included in software employment (computer programmers and software engineers). Hence, directly relating these two datasets would be akin to comparing apples and oranges. The closest occupational category to computer-related occupations is the broader Standard Occupational Classification of SOC 15-0000 “Computer and Mathematical Occupations.”<sup>13</sup> In May 2005 total net employment in this category was 2.95 mil-

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lows: “Computer Software Engineers, Applications”—Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team. Exclude “Computer Hardware Engineers” (SOC 17-2061); “Computer Software Engineers, Systems Software”—Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications and formulate and analyze software requirements. Apply principles and techniques of computer science, engineering, and mathematical analysis. These definitions are available at [www.bls.gov/oes](http://www.bls.gov/oes).

13. This SOC major group comprises the following occupations: Computer and Information Scientists, Research; *Computer Programmers*; *Computer Software Engineers, Applications*; *Com-*

### **Box 3.1 The secure US job market for software workers in 2007**

Despite much concern, especially during the 2004 US presidential campaign, the US software sector has so far not relocated to India. Rather, it has in recent years positively thrived in global competition, any adverse effects from offshore outsourcing notwithstanding. Moreover, rapidly rising wages for high-skilled Indian workers suggest that the scope for further large-scale offshore outsourcing of US software work solely for the purposes of labor arbitrage may be narrowing. Recent anecdotal data suggest that salaries for top Bangalore-based software engineers have risen from 20 to 75 percent of US levels in just two years from 2005 to 2007,<sup>1</sup> while most wage surveys for broader categories of experienced workers still indicate that Indian wages are at about half of US levels.<sup>2</sup> Evidently, while there are thousands of highly skilled and competent Indians in the country's software sector, they are just not as cheap as they used to be, relative to US workers.

It is encouraging that literally thousands of high-skilled software positions are currently available in the United States. A quick search of US-based directly software-related job openings at the online career center of Microsoft, the largest US software company, at [members.microsoft.com/careers](http://members.microsoft.com/careers), on September 28, 2007 yielded 15 vacant positions for software architect, 716 vacant positions for software development engineer, and 515 vacant positions for software development engineer in testing/software test engineer.<sup>3</sup>

A similar search on the same day at the online career center at IBM at [www-03.ibm.com/employment/us](http://www-03.ibm.com/employment/us) for all positions in software engineering requiring a bachelor's, master's, or doctoral degree yielded 1,469 regular full-time US vacancies. Yet another similar online search, also on the same day, at Oracle, another large US software company, at [www.oracle.com/corporate/employment/index.html](http://www.oracle.com/corporate/employment/index.html), yielded more than 500 US-based vacant positions in product development posted during the preceding three-month period. In other words, in less than 10 minutes of searching on websites of just three large US software companies, this author found almost 3,000 vacancies for high-skilled software workers located all over the United States.<sup>4</sup>

Thankfully, one of the most vocal opponents of the H-1B visa program, the Programmers Guild, implicitly acknowledges this extremely benign job market for high-skilled US software workers in its April 2007 online newsletter. It states the following in response to a direct inquiry from a Microsoft hiring manager seeking high-skilled US software workers:<sup>5</sup>

*(box continues next page)*

### **Box 3.1 The secure US job market for software workers in 2007** (continued)

#### **Microsoft hiring manager seeks your resume**

This is not an April Fools' joke. Microsoft has several hundred openings, and a hiring manager has provided his personal email address, asking us to submit our resumes directly to him.

I encourage everyone who has at least a BS degree in Computer Science to send your resume. If American programmers don't even apply for these positions, then it is difficult to argue that we are being displaced by the H-1b workers who do apply. [emphasis in original]

Qualifications? Ideally you will have skills like SQL, C#, .NET or C++, or similar experience and competence in the Microsoft development platform. However, since Microsoft is sponsoring H-1b visas for new graduates—and H-1b workers cannot be hired until October 2007—a BS or higher degree alone should be sufficient for many of the positions that Microsoft is holding open for the H-1b workers it is sponsoring. . . .

With thousands of US-based high-skilled software positions available and a rapidly declining wage differential with Bangalore-based software engineers, the present and future labor market for US software workers in the global economy seem secure. Clearly, some high-skilled US software workers will lose their jobs, and for some it will likely be due to offshore outsourcing. However, with thousands of high-skilled software positions available in the United States, an unemployment rate of 2 to 3 percent, and rising total software employment, this group patently has employment security. Rather than guaranteeing workers their current jobs for life, a dynamic economy should provide them with the chance to always be able to find new jobs.

Some hedge fund managers will lose money even in a rising market, but bailing them out is hardly good government policy. Considering that many less-skilled US workers, for instance, in the manufacturing sector, face genuine hardships—the loss of both job and employment security—as a result of rapid technological innovation and increased global competition, it seems improbable that high-skilled US software workers would have any credible claim for scarce congressional attention or support.

1. "Bangalore Wages Spur 'Reverse Offshoring,'" *Financial Times*, July 1, 2007. See also Hewitt Associates LLC (2006) for wage data showing that double-digit real wage increases for Indian professionals have far outstripped those in other countries in recent years.
2. "Engaging India: Outsourcing in Jeopardy?" *Financial Times*, August 2, 2007. The rising wage trend in India seems to be pushing multinational companies to increasingly sell their captive units in India to local companies, which are better able to achieve economies of scale in operations for multiple clients.
3. These results include all US locations, products, and job subcategories.
4. The author conducted similar searches on the same websites on July 9, 2007 and obtained a similar result of more than 3,000 vacancies in the categories listed.
5. See Programmers Guild E-Newsletter, April 2007, available at [www.programmersguild.org](http://www.programmersguild.org).



lion workers. Hence, H-1B visa holders in computer-related occupations potentially present in the United States that year could at the most have amounted to about 11 percent of net employment in computer and mathematical occupations. This share is seven times higher than the share of all H-1B visa holders (roughly 1.5 percent) in the total high-skilled US population.

What about the most important labor-market price signal: wages? What has happened to the wages of US software workers in recent years? In terms of base wages, which exclude benefits, nonproduction bonuses, and supplementaries,<sup>14</sup> computer software engineers, at about \$84,000 per year in 2006, earned about 20 percent more on average (25 percent in terms of median wages) than did computer programmers (just below \$70,000 on average), reflecting the higher skill content of their work. In the aggregate, US software workers, therefore, earned between two and three times the US median base wage of \$30,400 in 2006.<sup>15</sup>

As can be seen in table 3.1a, base wages rose in nominal terms across the wage range by an average 25 to 30 percent from 1999 to 2006 for these groups of workers. This rise was about five percentage points above the rate of inflation over the period. Only the highest-earning computer programmers in the 75th percentile did worse, at about 17 percent base-wage growth over this period. This latter group of software workers therefore had negative base-wage growth from 1999 to 2006, as the consumer price index (CPI) rose by almost 20 percent from 1999Q4 to 2006Q2. Nonetheless, despite this outcome, computer programmers in the 75th percentile earned more than \$85,000 before any benefits, bonuses, or supplementaries in 2006.<sup>16</sup> It is not possible to discern from the Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) data any trends in the

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*puter Software Engineers; Systems Software; Computer Support Specialists; Computer Systems Analysts; Database Administrators; Network and Computer Systems Administrators; Network Systems and Data Communications Analysts; Computer Specialists, All Other; Actuaries; Mathematicians; Operations Research Analysts; Statisticians; Mathematical Technicians; Mathematical Science Occupations, All Other.* See [www.bls.gov/oes](http://www.bls.gov/oes). Italicized occupational categories are included in "software employment" above.

14. In detail, OES survey wages include straight-time gross pay, exclusive of premium pay. Base-rate cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pay including commissions and production bonuses, tips, and on-call pay are included. Back pay, jury duty pay, overtime pay, severance pay, shift differentials, nonproduction bonuses, employer cost for supplementary benefits, and tuition reimbursements are excluded. See OES technical notes at [www.bls.gov/oes/current/oes\\_tec.htm](http://www.bls.gov/oes/current/oes_tec.htm).

15. This number is the annual median wage estimate for "All Occupations" from the May 2006 BLS OES estimates. See table A.4 in the statistical appendix for more details.

16. The BLS OES program covers only full-time and part-time wage and salaried workers in nonfarm industries. The survey does not include self-employed owners and partners in unincorporated businesses, household workers, or unpaid family workers, which means that independent self-employed IT consultants are not included in these data.

**Table 3.1a Annual base wages of US software workers, 1999 and 2006 (US dollars)**

Occupation	Mean wage	10th percentile wage	25th percentile wage	Median wage	75th percentile wage	90th percentile wage	Consumer price index
Computer programmers							
1999Q4	54,960	29,650	38,780	51,060	72,780	91,260	168.4
2006Q2	69,500	38,460	49,580	65,510	85,080	106,610	(1999Q4)
Change, 1999Q4–2006Q2 (percent)	26.46	29.71	27.85	28.30	16.90	16.82	
Software engineers							
1999Q4	65,969	40,036	50,179	63,873	80,652	98,142	201.7
2006Q2	84,155	51,086	64,796	82,075	101,286	122,225	(2006Q2)
Change, 1999Q4–2006Q2 (percent)	27.57	27.60	29.13	28.50	25.58	24.54	19.77

Sources: Bureau of Labor Statistics, Occupational Employment Statistics, available at [www.bls.gov/oes](http://www.bls.gov/oes); Bureau of Labor Statistics, Consumer Price Indexes, [www.bls.gov/cpi](http://www.bls.gov/cpi).

value of non-base wage remuneration for US software workers from 1999 to 2006 and therefore not possible to answer the question whether there are systematic biases in the base-wage to non-base wage remuneration ratio across the wage spectrum. This would be the case, for instance, if the highest-earning software workers received a higher share of their total remuneration in the form of, say, stock options than did workers at the low end of the wage spectrum.

Table 3.1b shows that in terms of relative base-wage growth between 1999 and 2006, US software workers belong to the top quintile of the US workforce when compared with the wage growth in other major occupational categories.<sup>17</sup> US workers in only three major occupational categories—management, healthcare practitioners, and business and financial occupations (in other words bosses, doctors, and bankers), representing 14 percent of the total US wage and salaried workforce—saw higher median wage increases than did US software workers over this period. In the aggregate, not too bad for an occupation that over the 1999–2006 period experienced very large relative inflows of foreign high-skilled workers (see chapter 2). The bottom line: Any detrimental effect on software workers’ wages from the inflow of foreign high-skilled workers is far from obvious.<sup>18</sup>

It is important to elaborate on the period chosen for tables 3.1a and 3.1b, because the starting and end points of wage growth estimations similar to those in tables 3.1a and 3.1b are crucial. The 1999–2006 period was chosen first and foremost because complete data are available for that period. It is not possible to go back to a starting year earlier than 1999 because the BLS survey methodology was changed in 1999. At the same time, it is historically evident that software workers went through a tremendous boom-bust cycle from 1999 to 2001–02. The fact that data are available from 1999 onward, however, offers a nice opportunity to slice through the top of the internet boom-bust variation. In 1999Q4 (the period to which the 1999 estimates are benchmarked), total US employment was 130.2 million, while at the end of the March–November 2001 recession in December 2001 it was 130.7 million after having peaked at a seasonally adjusted value of 132.6 million in February 2001. Using 1999 data as the start-

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17. The level of occupational categories at which one makes this comparison is important, as individual subgroups within the major occupational category shown in tables 3.1a and 3.1b may differ from the higher classification category value. As can be seen in table A.4 in the statistical appendix, the threshold for inclusion in the 90th percentile measured at the level of the total workforce in 2006 was \$72,960, indicating that the average computer programmer was about \$2,500 away from inclusion in the 90th percentile.

18. Findings in Aldonas, Lawrence, and Slaughter (2007) indicate that as a group in terms of real money earnings (real money earnings in this analysis exclude the value of benefits and equity/stock option grants and are deflated by the CPI), both US college graduates and US master’s degree holders saw declines in the period 2000–2005. In other words, US software workers in all probability did far better on wages than even the majority of other US high-skilled workers during this period.

ing point is therefore a sensible approximation of the “sustainable level of employment,” thus eliminating the final and worst bubble excesses from 1999 to 2000.

Given the intensity of the boom in software-related occupations in the late 1990s, one would expect this particular category of workers to have experienced the highest wage increases among US workers from 1999 to 2001 while at the same time also a sharper drop during the subsequent bust. Figure 3.2, which shows the real median base-wage developments for US software workers relative to selected occupational categories, illustrates that at least part of these predictions indeed materialized.<sup>19</sup>

Computer programmers (in particular) and software engineers did experience the highest base-wage growth rates of any major occupational category from 1999 to 2001, after which management occupations overtook them. However, it is noteworthy that US software workers “gave up” fewer of these “boom-year” median-wage gains during the subsequent bust than what one would have predicted, especially considering the continued inflow of foreign high-skilled workers to these occupations (see chapter 2). Instead, median wage developments for US software workers after 2001 pretty much mirrored those among other occupational categories—i.e., were basically flat.<sup>20</sup> Hence, by 2006 this group of high-skilled workers was still found to be among the top quintile of American workers in terms of wage growth over the entire 1999–2006 period. As can also be seen in figure 3.2, American workers who have really suffered in terms of relative real wage growth are those in traditional low-skilled occupations, such as food preparation, personal care, and construction.

While the aggregate real base-wage developments for US software workers in recent years have not been as buoyant as these workers would have liked, they are nonetheless on par with the—likely equally disappointing—real wage developments in the broader US economy. As such, there is precious little empirical support for assertions that US software workers have been adversely affected by the large inflows of foreign high-skilled workers to their occupation. Instead, they have held their ground quite nicely in an overall economic environment of stagnant real wages (see table A.4 in the statistical appendix for a detailed listing of employment and real wage developments in US occupations from 1999 to 2006).

This section has perhaps not definitively answered whether US software workers have been adversely affected by foreign high-skilled entrants to the workforce, because it does not address the hypothetical

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19. The deflator used is the BLS CPI, all items, seasonally adjusted city average. Data for “All Occupations” are available only from 2001 onward.

20. As can be seen in figure 3.2, the biggest beneficiaries of the 1999–2001 internet boom, computer programmers, have from 2001 to 2006 seen a small decline in real wages similar to that found among some lower-skilled occupations.

**Table 3.1b Change in base wages for major SOC groups, ranked by median wage change, 1999–2006 (percent)**

Occupation	Mean wage	10th percentile wage	25th percentile wage	Median wage
Management	42.0	42	42	40.64
Healthcare practitioners and technical	37.1	30	31	33.45
Business and financial operations	30.2	27	27	28.54
Software engineers	27.6	28	29	28.50
Computer programmers	26.5	30	28	28.30
Life, physical, and social sciences	30.7	26	25	27.43
Computer and mathematical (all)	26.1	21	24	27.20
Architecture and engineering	28.3	24	26	26.76
Protective services	24.9	20	25	24.25
Farming, fishing, and forestry	21.2	18	20	23.96
Sales and related	26.9	18	22	23.52
Healthcare support	24.4	23	24	23.22
Legal	27.8	24	26	22.88
Community and social services	23.3	22	22	22.86
Education, training, and library	25.7	28	24	22.39
Production	20.0	18	20	22.36
Office and administrative support	20.0	17	19	21.24
Arts, design, entertainment, sports, and media	22.5	27	24	21.18
Building and grounds cleaning and maintenance	19.4	17	20	20.70
Transportation and material moving	19.6	18	19	19.23
Installation, maintenance, and repair	19.0	18	19	18.95
Food preparation and serving related	18.1	9	13	18.89
Personal care and services	12.9	12	16	17.21
Construction and extraction	16.8	18	18	15.00

n.a. = not available

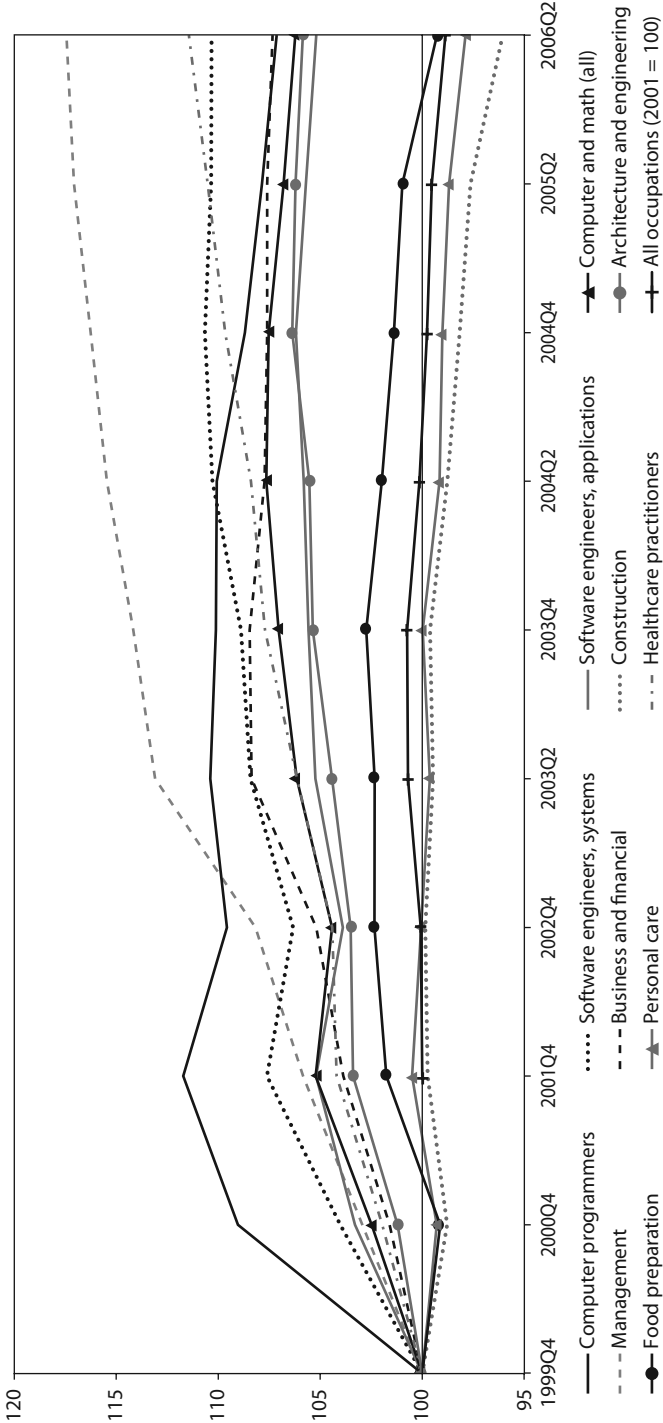
SOC = Standard Occupational Classification

Note: Wages from the Bureau of Labor Statistics, Occupational Employment Statistics survey are straight-time, gross pay, exclusive of premium pay. Base rate, cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pay including commissions and production bonuses, tips, and on-call pay are included. Excluded are back pay, jury duty pay, overtime pay, severance pay, shift differentials, nonproduction bonuses, employer cost for supplementary benefits, and tuition reimbursements. Shaded occupations are the focus of this chapter.

Sources: Bureau of Labor Statistics, Occupational Employment Statistics, available at [www.bls.gov/oes](http://www.bls.gov/oes); Bureau of Labor Statistics, Consumer Price Indexes, [www.bls.gov/cpi](http://www.bls.gov/cpi).

<b>75th percentile wage</b>	<b>90th percentile wage</b>	<b>Annual average wage, 2006Q2 (US dollars)</b>	<b>Annual median wage, 2006Q2 (US dollars)</b>	<b>Share of total US employment (percent)</b>	<b>Cumulative share of US employment (percent)</b>
38	n.a.	91,930	80,980	4	4
36	43	62,030	51,980	5	10
31	32	60,000	53,690	4	14
26	25	69,500	65,510		
17	17	84,155	82,075		
33	35	59,660	53,010	1	1
28	26	69,240	66,130	2	3
28	27	66,190	62,390	2	5
25	25	37,040	32,070	2	7
22	21	21,810	17,950	0	8
26	29	34,350	23,160	11	18
25	27	24,610	22,870	3	21
20	n.a.	85,360	67,730	1	22
23	23	39,000	35,790	1	23
24	26	45,320	41,100	6	29
19	18	30,480	27,360	8	37
21	19	30,370	28,080	17	54
19	18	46,110	38,340	1	56
21	19	22,580	20,290	3	59
18	17	29,460	25,300	7	66
19	18	39,060	36,720	4	70
21	24	18,430	16,430	8	79
16	9	22,920	19,070	2	81
15	18	39,290	35,450	5	86

**Figure 3.2 Real median wages, selected occupational categories, 1999–2006 (1999Q4 = 100, CPI deflated)**



CPI = consumer price index

Source: Bureau of Labor Statistics, Occupational Employment Statistics, available at [www.bls.gov/oes](http://www.bls.gov/oes); Bureau of Labor Statistics, Consumer Price Indexes, All Items Data, [www.bls.gov/cpi](http://www.bls.gov/cpi).

question of what would have happened to US software workers if foreign high-skilled worker inflows were absent. Such “what if” estimates require substantially more data than what are available for the detailed category of software workers.<sup>21</sup> From the standpoint of basic labor economics, it is straightforward to hypothesize that, in the absence of inflows of foreign high-skilled workers to their occupation from 1999 to 2006 (described in chapter 2), US-based software workers would in all probability have seen even higher wage increases than what were found to have materialized (tables 3.1a and 3.1b and figure 3.2). However, given the findings here—that we are dealing with a group of American workers who in terms of base-wage increases from 1999–2006 belong to the top quintile—the pertinent policy question cannot be, How much more would US software workers have earned without the H-1B visa program, for instance? Instead, a more pressing policy question must be: At what costs to the rest of the US economy would additional economic rents accruing to this group come?

In summary, this section has raised several noteworthy issues concerning the labor-market situation US software workers have faced in recent years.

First, unemployment rates among software workers have been at full employment levels since 2005. Second, employment in software occupations in mid-2006 (latest available) was at an all-time high at 1.2 million workers. Third, the composition of the software workforce has changed, with higher-skilled software engineers making up two-thirds of the total software workforce in 2006 and computer programmers one-third, as opposed to both having been at the same level in 1999. This general development toward higher skill content in the US software workforce is predictable for a high-wage country. Fourth, between 1999 and 2001 base wages of the US software workforce—which are at two to three times the US average base wages—rose faster than those in any major US occupational category, while from 2001 to 2006 they changed at essentially the same rate as those for the rest of the US workforce. Finally, real base wages for the US software workforce have risen substantially more than

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21. See Borjas (2001, 2003) and Ottaviano and Peri (2006) for examples of such approaches, utilizing factor proportions models and attempts to control for endogenous effects (i.e., that immigrants disproportionately settle in areas with high levels of wage increases). These approaches, however, work on more aggregate worker categories where more data are available. Madeline Zavodny (2003) attempts to estimate the wage and employment impacts of the H-1B program using the number of the Department of Labor’s so-called labor condition applications (LCAs)—the first step in an H-1B application—as a proxy. This is an admirable attempt by Zavodny to use available data to shed light on this issue. However, as described in Kirkegaard (2005), the data uncertainties related to the firm-level LCA data (available at [www.flcdatacenter.com](http://www.flcdatacenter.com)) are so daunting that their validity is terminally impaired. Zavodny (2003, 7) nonetheless concludes that “H-1B workers also do not appear to depress contemporaneous earnings growth.... H-1Bs do not appear to have an adverse impact on contemporaneous unemployment rates.”



base wages earned by more than 80 percent of the total US workforce. This rise in wages has come despite a significantly larger presence of foreign workers on H-1B visas in computer-related occupations than in other high-skilled occupational categories. This clearly suggests that foreign workers in this field are in general complements to US workers, rather than substitutes.

These findings make it hard if not impossible to convincingly argue—media anecdotes notwithstanding—that the aggregate labor-market situation facing the US software workforce has, after a postinternet boom downturn, been or remains anything other than booming relative to the rest of the US economy despite far larger inflows of foreign workers than in any other high-skilled area in recent years. These findings thus follow earlier studies such as Lowell and Christian (2000), the National Research Council (2001), and Zavodny (2003), all of which found that adverse effects of the H-1B program on native US workers could not be estimated with confidence.

These findings thrust a heavy burden of both proof and responsibility onto the shoulders of those publicly espousing the view that young Americans have next to no future in software occupations due to the inflow of foreign high-skilled workers to the United States, as well as the broader phenomenon of offshoring in the IT sectors.<sup>22</sup> It would be a tragedy if young people in the United States today were indeed turned off from pursuing careers in software occupations due to excessive alarmist rhetoric on this subject instead of being given the facts on the actual labor-market situation, based on empirical investigations using official publicly available data, such as those presented in this policy analysis.<sup>23</sup>

Furthermore, recent developments in the United Kingdom are consistent with the finding that high levels of foreign workers have had no significant adverse effects on US software workers. Data from the UK Home Office show that during 2006, 33,756 new work permits were issued to foreign IT workers. About 80 percent (26,835) were issued to Indian IT workers. As the total UK workforce was only about one-fifth of that in the

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22. For an example of such a line of argument, see, for instance, Hira and Hira (2005), in particular the foreword in it by Lou Dobbs.

23. It is noteworthy that this concern is not an isolated US phenomenon. In their September 2007 communication to the EU Council concerning the imminent shortage of e-skills in the European Union, the European Commission notes: “Higher-level e-skills cannot be easily encoded, which puts a premium on these skills in a European workforce context. The issue is debated in the media as the emergence of a significant restructuring of the labour market. Several sources report a deterioration of the image of the ICT sector and ICT work, which is reflected in the decline in the number of students starting ICT courses” (European Commission 2007, 5).

United States in 2006,<sup>24</sup> this figure would correspond to an annual inflow of foreign IT workers to the United States in 2006 of more than 170,000 (of which about 140,000 would be Indians). This number is a third more than the peak inflow to the United States in 2001, when about 110,000 H-1B visas for initial employment in computer-related occupations were issued (see table 2.2). Simultaneously, in 2006, wages for IT professionals in the United Kingdom rose by substantially above the national UK average to £34,500 (about \$65,000 in 2006).<sup>25</sup> The UK data further illustrate that large inflows of foreign, especially Indian, technology workers are not limited to the United States and that other countries are increasingly permitting such inflows.<sup>26</sup>

US law sensibly requires that the foreign high-skilled entrants to the workforce requiring an FLC be paid the “prevailing wage,” which is defined by the Department of Labor “as the average wage paid to similarly employed workers in the requested occupation in the area of intended employment.”<sup>27</sup> It is beyond the scope of this policy analysis to evaluate whether computer-related or other foreign high-skilled H-1B workers are generally remunerated according to US law.<sup>28</sup> Opinions vary significantly on this matter,<sup>29</sup> but as laid out earlier, the overall labor-market situation facing US software workers is quite auspicious. Given the very high concentration of H-1B use among a limited number of IT services and software companies, any enforcement effort to ensure that US laws are being adhered to in this sector would seem quite manageable, especially as each H-1B (and L-1) application must (since May 2005) be accompanied by a special \$500 “fraud prevention and detection fee,” which is earmarked for enforcement.<sup>30</sup>

It is noteworthy that in June 2007 the Department of Labor settled a major case for \$2.4 million (or about \$4,000 per person) with Patni Computer Systems, Inc.—one of the top 10 H-1B employers (table 2.3)—con-

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24. 28 million workers in the United Kingdom versus 144 million in the United States, according to OECD labor-market data.

25. All data are from ATSCO (2006, 2007).

26. ATSCO (2007) shows that issuance of new IT work permits in the United Kingdom more than doubled by 2006 from just 12,726 in 2000.

27. See page on Frequently Asked Questions on Foreign Labor Certification Prevailing Wages at [www.foreignlaborcert.doleta.gov/wages.cfm](http://www.foreignlaborcert.doleta.gov/wages.cfm).

28. Until the Omnibus FY2005 Appropriations bill (HR 4818), which raised it to 100 percent, the “prevailing wage” was legally defined as only 95 percent of what US workers earned. See Kirkegaard (2005) for data showing that employers made wide use of this loophole.

29. See, for instance, Miano (2007) or Hira (2007).

30. See USCIS press release, USCIS Implements L-1 Visa Reform Act of 2004, June 23, 2005, at [www.uscis.gov](http://www.uscis.gov).

cerning 607 H-1B workers who had not been paid prevailing wages during 2004–05.<sup>31</sup> More such targeted enforcement of existing laws would seem the appropriate answer to any concerns over possible underpayment by IT services companies of foreign high-skilled H-1B workers.

## Matching Employers with Foreign High-Skilled Workers

Thanks to internet-based job searches and advertising, high-skilled workers, employers, and other potential foreign employees rarely face overwhelming informational obstacles in “matching each other in a labor market” across international borders. This is particularly so in the United States and other English-speaking nations (but also to a lesser degree in French- and Spanish-speaking nations). English is the lingua franca of international business, and a substantial potential pool of English-speaking foreign high-skilled workers exists outside US borders. For high-skilled workers, the principal practical obstacle to cross-border labor-market matching is immigration laws. The degree to which a country’s laws choose to accommodate (or not) this relatively easy high-skilled cross-border labor-market matching is a straightforward immigration policy choice.

As mentioned in chapter 1, immigration flows that are family-based, humanitarian, and illegal in nature are of limited high-skilled relevance, and immigration policies emphasizing these types of flows—as in the United States presently—relative to employment-related or student-based immigration thus explicitly downplay the importance of the skills component. However, there are also important differences in the way employment (and student)–oriented immigration functions in terms of guiding domestic employers to potential foreign high-skilled recruits.

Employers in the OECD are generally free to transfer top foreign researchers and executives to a particular country, as is done via the US L-1 visa program. Employers are hence free to manage entirely on their own the cross-border selection of this particular group of high-skilled workers. Alternatively, countries utilize a range of criteria, such as educational qualifications (similar to the requirement in the US H-1B system of at least a bachelor’s degree or equivalent), salary levels, or a government-provided list of “occupations with labor shortage” or quotas (like the annual 65,000 H-1B visa cap in America).

Several, especially other Anglo-Saxon, countries utilize so-called points systems, where foreign workers can qualify for a work permit if they obtain a certain number of points, based on a government-issued and usually skills-oriented criteria list. A major advantage of the points system

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31. See Department of Labor press release dated June 7, 2007, at [www.dol.gov/opa/media/press/esa](http://www.dol.gov/opa/media/press/esa).

is its flexibility, as it can, in theory, be relatively easily calibrated to target particular categories of foreign skills needed at a particular time in the national labor market. Targeted foreign workers can subsequently “self select” and apply of their own initiative or even choose to upgrade their skills prior to applying, should it be required to meet the threshold. Points systems are inherently more focused on skill levels than, say, family-based immigration systems and hence are preferable for alleviating skill shortages.

However, points systems also have drawbacks. As laid out in OECD (2007c, 97ff), their efficient operation requires a substantial and expensive apparatus for verifying foreign-earned credentials and diplomas. Also, points systems frequently substitute educational attainment and degrees for actual skills and qualifications demanded by employers. While any degree holder will be preferred in skill terms to one with no degree, a points system nonetheless runs the risk of facilitating immigration of high-skilled workers—say, liberal arts graduates—less employable than those graduates possessing skills, say, in the science and engineering fields, directly sought by employers. Hence, in terms of labor-market efficiency, a system—like the US H-1B (and L-1)—that allows employers themselves to directly locate, screen, and ultimately via an employer-sponsored work visa hire foreign high-skilled workers is preferable in labor-market efficiency terms to a points-based high-skilled immigration system.

The use of quotas for high-skilled immigration purposes is invariably the worst possible approach from the perspective of labor-market efficiency. It is basic trade economics that quotas imply an inescapable efficiency loss. Moreover, in immigration, their use raises the issue that the number of permits legislatively permitted—like the *rhetorical* 65,000 H-1B cap in the United States—is set *ex ante*, while actual labor-market needs are ascertained *ex post*.<sup>32</sup> So even if politicians set a high-skilled worker quota based on objective demand criteria rather than exogenous political pressures, which is extremely unlikely, they would still be overwhelmingly likely to get it badly wrong. The initial H-1B cap was set at 65,000 in the Immigration and Nationality Act of 1990 based at least partly on earlier years’ high-skilled worker inflows, and it has returned to this level in FY2004. The H-1B program is a clear example of demand-supply mismatch: In the spring of 2007, the entire quota for FY2008 was used up in less than a day!<sup>33</sup>

Another example of the nonsensical use of prefixed quotas for high-skilled visas is the special H-1B carve-outs (see below) that Chile and Singapore received with their free trade agreements (FTAs) with the United

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32. See OECD (2007c, 97ff) for an elaboration of this sequencing issue.

33. See USCIS press release, USCIS Runs Random Selection Process for H-1Bs, April 13, 2007 (revised), at [www.uscis.gov](http://www.uscis.gov). The technicalities of this oversubscription are discussed later.

States. These two countries get “first choice” of a total of 6,800 H-1B visas annually (or more than 10 percent of the total). If nationals of the two countries do not use the entire quota of these 6,800 visas, also referred to as H-1B1, then the remaining roll over to the initial “open pool” of 58,200 in the following fiscal year. In FY2006 nationals of Chile and Singapore used only 700—just 10 percent—of the 6,800 H-1B visas that their trade negotiators secured for them.<sup>34</sup> Certainly this system works wonderfully for US employers of high-skilled Chileans and Singaporeans, who are guaranteed an H-1B visa should they apply. However, while it is unclear just what concessions the two countries had to give during the FTA negotiations in exchange for their quota carve-outs, the 10 to 1 mismatch between the quota and its actual use amply illustrates the difficulties of predicting ex ante the correct size of a high-skilled visa quota. A similar situation can be seen with the E-3 high-skilled visas for Australian nationals, of which 10,500 were made available in late 2005 based on the US-Australia FTA.<sup>35</sup> In 2006, the first full year the quota was in force, just 1,918 “Australian specialty occupation professionals” were issued visas—i.e., less than a fifth of the available number of visas!<sup>36</sup>

Moreover, the bottleneck of a quota creates adverse incentives and harmful uncertainty for business planning. With the economic future evidently always uncertain, companies that most depend on foreign workers will rationally seek to acquire as many visas under the quota as possible—“visa hoarding” is the rational response to this scarce resource—both to guarantee their own access to foreign high-skilled workers and to deny that access to their competitors. It is therefore no surprise that several Indian (and US) IT-related companies dominate the H-1B program. They simply have the most at stake and the biggest economic interest in acquiring these visas.

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34. See USCIS press release, USCIS Reaches H-1B Cap, June 1, 2006 at [www.uscis.gov](http://www.uscis.gov). Subsequently, 6,100 of the two countries’ FY2006 quota were allocated to the open pool of 58,200 in FY2007 for an initial total of 64,300.

35. The law was publicized in the *Federal Register* on September 2, 2005. Unlike the FTAs with Singapore and Chile, the US-Australia FTA has, following the congressional turf war over this issue, no direct mention of the high-skilled immigration issue. Indeed, a side letter to the agreement specifically states that “no provision in it shall be construed to impose any obligation on a party regarding its immigration measures.” See the side letter on immigration in chapter 10 of the final text of the US-Australia FTA, available at the USTR website, [www.ustr.gov](http://www.ustr.gov). This side letter is merely a legal fig leaf, aimed at pleasing the US Congress to make it appear that there is no link between FTAs and US immigration law. The *Federal Register* on September 2, 2005 announced the new rule, following an amendment to the Immigration and Nationality Act of 1990 attached to the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Tsunami Relief, 2005, Public Law 109-12 119 Stat. 231, which created the E-3 visa *only* for Australians.

36. Children or spouses of specialty occupation recipients took 1,053 E-3 visas in 2006. See Department of State (2006, table XVI (B)).

Hence, such companies are likely to mobilize substantial economic resources toward this goal. Stuart Anderson (2006) in testimony before the US Congress estimated that each H-1B visa today costs up to \$5,000 to \$6,000, depending on whether employers pay the \$1,000 “premium processing fee.” Infosys, the top user of H-1B visas (table 2.3), stated the following in its 2007 20-F filing:

In addition, the availability of visas for working in the United States may vary substantially from quarter to quarter. Visas for working in the United States may be available during one quarter, but not another, or there may be differences in the number of visas available from one quarter to another. As such, the variable availability of visas may require us to incur significantly higher visa-related expenses in certain quarters when compared to others. For example, we incurred \$11.0 million in costs for visas in the three months ended June 30, 2006, compared to \$3.0 million for the three months ended March 31, 2006. Such fluctuations may affect our operating margins and profitability in certain quarters during a fiscal year.<sup>37</sup>

With Infosys and likely most other companies at the top of the H-1B usage list literally spending millions of dollars each quarter on securing these visas, potentially interested US employers with less financial resources to pay immigration lawyers and fees—such as most US startups and small and medium-sized enterprises—are certain to lose out in accessing foreign high-skilled talent.

Perversely, one might argue that an “H-1B auction system” has inadvertently been established such that only those companies with the greatest economic interest in acquiring H-1B workers may do so in reality. In some respects such an implicit H-1B auction system would be economically efficient but begs the question why the US Citizenship and Immigration Service (USCIS) and immigration lawyers should reap the majority of the proceeds from such an auction?

Such H-1B auction rents are far from negligible. Through current visa regulations, the USCIS estimates that in FY2006 it “earned” \$138 million in annual fee revenue.<sup>38</sup> The Omnibus FY2005 Appropriations bill (HR 4818) earmarks \$1,500 per application as a “retraining fee,”<sup>39</sup> which goes toward US workers, and \$500 as an “antifraud fee,” which goes toward enforcement activities. However, these data include only the 85,000 fully fee-earning H-1B visas processed annually under the congressional cap.

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37. Available at the Securities and Exchange Commission's EDGAR database for company information at [www.sec.gov/edgar](http://www.sec.gov/edgar).

38. Based on 85,000 fee-paying petitions. The Office of Management and Budget (OMB Circular no. A-25 on “User Charges”) demands that federal agencies charge “full cost” of providing special benefits to a recipient when calculating fees. Full cost is defined as “all direct and indirect costs to any part of the Federal Government of providing a good, resource or service.” See Gonzalez (2007) and GAO (2005).

39. It is \$750 for companies employing fewer than 25 full-time employees.

Yet, table 2.1 showed that in FY2005, more than 267,000 H-1B visas were issued when all categories are included. This implies that when viewed from the perspective of US-based employers—who ultimately pay the bills—the total annual costs of acquiring H-1B visas may have approached \$1 billion in FY2005.

A “back-of-the-envelope” estimate, based on Anderson (2006), for total costs of \$5,000 per visa for the 85,000 visas under the FY2005 cap and \$3,000 for all 182,000 visas granted that did not count toward the cap in FY2005 (which means that they were exempt from the fees mentioned above) equals total costs in the \$1 billion range.<sup>40</sup> As currently implemented, the H-1B cap thus clearly favors highly H-1B dependent Indian IT companies and (as usual) US lawyers.

Given this cost level for US businesses, it is ironic that the USCIS in April 2007, following the receipt of more than 123,400 H-1B applications on April 2–3, introduced a lottery (or in USCIS language, “computer-generated random selection process”) to distribute the 65,000 visas available in FY2007.<sup>41</sup> While in some respects perhaps legally fair, such a lottery approach is without doubt the least economically efficient way to match employers and foreign high-skilled workers.

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40. GAO (2005) indicates that US businesses may spend more than \$100 million on accessing the 20,000 H-1B visas available to foreign recipients of master's degrees or higher at US universities.

41. See USCIS press release, Change in H-1B Procedures Trims Weeks off Final Selection Process, April 19, 2007, at [www.uscis.gov](http://www.uscis.gov). April 1, 2007 was a Sunday, and hence the USCIS started receiving petitions only on April 2. The agency did not notify the public until April 3 that the cap of 65,000 had been reached (USCIS press release, USCIS Reaches FY2008 H-1B Cap, April 3, 2007), and it was subsequently administratively determined that all petitions filed prior hereto had been legally received on the “final receipt day.”

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## A Reform Package

The recent debate in America on immigration reform has failed to pay sufficient attention to several accelerating trends in immigration of high-skilled workers. While legislated, the US high-skilled immigration system has been largely left unreformed and has become increasingly dysfunctional. US policymakers must urgently acknowledge the accelerating trends, summarized below, before they produce a crisis.

### Summary of Findings

This policy analysis has established the following findings:

**The Era of Rising Skill Levels in America's Labor Force Is Drawing to a Close.** Overall skill levels in the US workforce have stagnated in the last 30 years. Measured by educational attainment, new cohorts of workforce entrants aged 25–29 and 30–34 do not possess higher skills than soon-to-retire baby boomers aged 55–59. This indicates that the qualitative, compositional improvement of the skill level in the US labor force associated with the retirement of workers less skilled than those entering will stop for the first time in US history. Retiring baby boomers will take as many skills with them into retirement as their children simultaneously entering the workforce possess.

**The Number of High-Skilled Workers in Other Countries Is Rising Faster than in America.** American baby boomers aged 55–64 led the global economy in tertiary education when they entered the workforce in the 1970s. Today's American workforce entrants aged 25–34 barely make the



global top 10, signifying that America will soon start dropping down the list of nations with the most skilled workforces. At least ten percentage points more of young workforce entrants in Russia, Canada, Japan, and Korea today have a tertiary degree than does the present share of youngsters in America. This indicates that present and future generations of Americans may not possess the same relative skill advantages to thrive in the global economy as did Americans aged 55+.

**Science and Engineering Degrees Are Still Popular.** Measured as a share of the total number of bachelor's, master's, and doctoral degrees granted by US universities, science and engineering (S&E) degrees have held largely steady at least since the mid-1970s. Shortages of new S&E graduates are thus related more to the general educational stagnation in the United States than to any relative decline in popularity of these fields.

**Foreign Science and Engineering Students Have Been Numerous at US Universities for a Generation.** The foreign share of US S&E students rose substantially during the 1990s and has now stabilized at more than a third after a 9/11-related decline. More than half of all engineering and computer science students at US universities in 2005 were foreign. However, as far back as the 1980s, this share was 40 percent or more.

**OECD Countries Are Increasingly Shifting Toward Managed Immigration, Focusing More on High Skills than Is America.** In 2005 the United States had the most family-oriented immigration policy of the 17 OECD countries for which data were available. Many OECD countries, including those outside the group of traditional Anglo-Saxon immigrant destination countries, are aggressively courting high-skilled immigrants and especially copying US efforts to attract foreign students and provide them with employment opportunities. Moreover, traditional origin countries of many high-skilled emigrants to the United States, like China, have in 2007 actively begun luring their nationals back via special offers. This raises the question whether the United States can retain its large share of all foreign high-skilled immigrants and maintain its traditionally very high retention rate among its foreign student body.

**High-Skilled Immigrants Are Increasingly Important as US High-Tech Entrepreneurs.** Up to 25 percent of all US high-tech startups since the early 1990s have had at least one foreign-born cofounder. This share is an increase from less than 10 percent in the 1970s.

**Green Cards Keep High-Skilled Foreigners in the United States, but Don't Grant Them Entrance.** More than 90 percent of the green cards (i.e., the granting of legal permanent residence [LPR] status) to high-

skilled immigrants are issued via adjustments in visa status requested for high-skilled foreigners already residing and (most likely) employed in the United States. Green cards are thus important predominantly as a tool to maintain the existing high-skilled workforce in the United States, rather than expanding it. This indicates that temporary visas perform a “gate-keeping” function for most high-skilled permanent immigrants to the United States and that overwhelmingly it is temporary work visas, rather than green cards, that in the first place attract “the best and the brightest” to the United States.

**The Present Green Card System May Force Many Employed High-Skilled Workers to Leave the United States.** Due to the limited number of green cards that can be issued to any single country’s nationals, most high-skilled immigrants from China, India, and the Philippines have had to wait several years to be able to acquire permanent residency in the United States. Such national bottlenecks in the green card system may force many of them to abandon high-skilled US employment and leave the US workforce.

**The Current Cap on Annual H-1B Issuance Is Pure Political Rhetoric.** More than 275,000 H-1B visas were issued in FY2004 and FY2005, despite the cap being nominally set at 65,000. This is a direct and intentional result of congressionally mandated legal exceptions and is unrelated to large-scale visa fraud.

**A Dual Trend Dominates Temporary High-Skilled Visa Issuance in the L-1 and H-1B Programs, and Indians Now Dominate Both.** The issuance of H-1B and L-1 visas to Indian nationals has rapidly increased in recent years, so that Indians now account for 30 to 50 percent of all temporary high-skilled visas issued, depending on the subcategory. Visa issuance to nationals from the rest of the world has been largely stagnant since 2000. More detailed occupational data for H-1B recipients show that the gross number of Indian recipients, recipients in computer-related occupations, and recipients in the IT services sectors fluctuates wildly and broadly as would be directionally predicted by the business cycle. Gross H-1B visa issuance to other recipient categories is generally stable. Foreign high-skilled workers in computer-related occupations in all probability increasingly dominate both programs.

**New Firm-Level Data on L-1 and H-1B Usage for 2006 Show a Limited Number of Indian IT Companies at the Very Top.** Recent data released by Senators Richard Durbin and Charles Grassley on employers that request L-1 and H-1B visas show that up to a dozen Indian IT services/software companies were the top petitioners of L-1 and H-1B visas in 2006. Several major US IT companies are also heavy users of the two programs.

However, Indian IT services/software companies do not feature beyond the top 10. Instead, a very broad range of US and multinational companies, as well as US public institutions from different sectors of the US economy, account for the remaining demand for foreign high-skilled workers. Firm-level data thus confirm the importance of both the L-1 and H-1B visas to the IT services/software industries and a few Indian companies in particular, while simultaneously indicating a broad-based demand for foreign high-skilled workers throughout the US economy.

**US Software Workers Have Not Been Adversely Affected by the Uniquely Large Inflow of Foreign High-Skilled Workers in this Occupation.** No other high-skilled occupation in the United States has seen an inflow of foreign workers that approaches that of software workers. Yet, numerous media reports and congressional testimony notwithstanding, unemployment rates for both US computer programmers and software engineers have hovered around 2 percent since 2005, indicating full employment in these occupations. Latest available data show total software employment was at a record high in 2006, surpassing the level reached at the peak of the internet/Y2K boom.

Wage growth for US software workers has in recent years surpassed that for 80 percent of the US workforce. This further suggests that US high-skilled workers have not suffered adverse labor-market effects by the inflow of foreign high-skilled workers in recent years. It is therefore crucial that nonempirical alarmist rhetoric and anecdotes not be allowed to dominate the public discourse on this topic in America, as these will likely have an unwarranted negative effect on the willingness of US students to pursue careers in software occupations.

**The Use of Quotas for H-1B Visas May Generate up to \$1 Billion in Annual Rents in the Form of Fees to the USCIS and Immigration Lawyers.** Turning access to H-1B visas into a scarce resource through the use of a quota heavily favors the most resource-rich and intensive/dependent users of the program, likely at the expense of smaller US startups and small and medium-sized companies.

## **Implications and Recommendations for Reform**

Any reform of US immigration laws is today more than ever “politics as the art of the possible” rather than the ideal. As even successful education reforms take decades to yield marked skill improvements in the labor market, it should be noncontroversial that the United States will need to increase its intake of high-skilled foreigners to avoid substantial and broad skill shortages in the coming decade. Hence, the current overwhelming emphasis on family-based immigration must be altered in the direction

of a more skills-oriented approach. However, accepting that such fundamental redirection of US immigration policies invariably will touch upon areas and issues outside the subjects relevant to high-skilled immigration covered in this policy analysis, I will refrain from proposing sweeping reforms toward this broader goal.

Keeping in mind the current political sensitivity of the issue, most recently exemplified by the collapse of the June 2007 Senate immigration “grand compromise,” I instead offer a package of minimalist policy proposals—i.e., biased in favor of changes that are most necessary but require only the least ambitious legislative agenda. Proposing limited reforms is also acknowledging the fact that despite its increasing number of shortcomings, the US high-skilled immigration system does contain many well-functioning and efficient rules and regulations, altered at lawmakers’ peril.

## **Permanent Immigration—Green Card Issuance**

The present green card system generally functions reasonably well with respect to high-skilled workers and ought to carry on with its current function as the principal means with which to keep the best and the brightest in the United States rather than attract them. The findings in this policy analysis suggest that, apart from speeding up the processing of LPR applications, two changes to current rules should be made:

**Drop the Department of Labor (DOL) Foreign Labor Certification for LPR Categories E-2 and E-3.** The US labor force will shortly start experiencing a stagnation in the skill level of the resident workforce, leaving the resident high-skilled workers unaffected by foreign high-skilled inflows. Hence the current requirement that foreigners seeking LPR status in categories E-2 and E-3 obtain a labor-market certification is superfluous and will only lead to rent-seeking behavior.

**Exempt LPR Categories E-1, E-2, and E-3 from the Annual Per-Country National Limit.** High-skilled foreigners from many different origins seek LPR status via the E-2 and E-3 categories, but the population sizes of countries vary widely. Recent evidence shows that literally hundreds of thousands of would-be permanent residents from China, India, and the Philippines applied for LPR status immediately when offered the chance in July and August 2007. Moreover, up to 40 percent of the world’s population is already from either India or China, and the pool of high-skilled university graduates from these two countries is expanding rapidly every year. It no longer makes any sense to restrict the number of high-skilled people who can annually enter the United States from any one country.

## L-1 Intracompany Transferees

The L-1 visa program grants employers utmost freedom to independently select which foreign high-skilled workers they require and bring them to the United States without having to concern themselves with visa quotas, labor certifications, or other regulatory obstacles. This is a very efficient program, which lets employers identify and access the precise foreign high-skilled workers they need. As such, no major specific reforms of the L-1 program are presently required.

However, the L-1 program has seen a major rise in applications filed on behalf of Indian nationals and is very intensively used by a very small group of Indian and US IT services/software companies. This finding broadly mirrors that for the H-1B program, and the appropriate, integrated policy response is covered in the next subsection.

## H-1B Specialty Occupations

The H-1B program, similar to the L-1 program, allows employers in the United States the freedom to identify the foreign workers who possess the skills they most require. This aspect of the H-1B program should be maintained, but several others need to be reformed.

**Drop the DOL Foreign Labor Certification for H-1B Workers.** This policy analysis has shown that despite the uniquely large inflows of high-skilled foreigners in computer-related occupations in recent years, US software workers in the aggregate have not suffered in the US labor market. Given that no other job occupation has seen inflows of the same magnitude and is thus extremely unlikely to have suffered as a result of such foreign inflows, the foreign labor certification for H-1B workers is unnecessary. When full employment exists in an occupation, there is no further economic or labor-market reason to demand that employers explicitly attempt to hire US workers before bringing in a foreign high-skilled worker. Considering the large additional administrative costs for companies—application filing fees, attorneys’ fees, time value of postponed hiring, etc.—it seems highly unlikely that any company would at prevailing wages seek to hire a foreign worker ahead of an American if the two possessed otherwise identical skill sets.

**Increase, Unshackle, and Target Enforcement of Prevailing Wages to Intensive Users of H-1B Visas.** H-1B workers must be paid prevailing US wages as determined only by the DOL, and, given the very high concentration of H-1B workers at a relatively small number of companies, the

appropriate way to do so is through unrestricted DOL enforcement of this provision.<sup>1</sup>

**Abolish the Annual Congressional Cap for H-1B Visas.** With high-skilled green cards overwhelmingly going to aliens already inside the United States, it is imperative that the “doorway of initial entry”—i.e., temporary high-skilled visas that attract the best and the brightest—be kept wide open. Visa quotas are inherently arbitrary, if not explicitly politically manipulated in size, and invariably lead to large efficiency losses. Moreover, this policy analysis has shown that the share of H-1B visas that go to initial employment (i.e., count towards the cap) in noncomputer-related occupations is relatively stable at about 65,000 to 75,000 in total during 2000–2005 (the period for which data are available). Given this stability and variety in noncomputer-related demand for H-1B visas, it is unlikely that abolishing the congressional cap will lead to a massive instantaneous increase in demand for visas, and hence the cap is unnecessary. Alternatively, a “de facto nonbinding cap” deliberately set at a sufficiently high level that would not be approached under normal economic circumstances—say, 500,000 annually—could be maintained in the books as a legal safety guard.

**Abolish the Annual 20,000 Congressional Cap and Grant Automatic H-1B Visas to Interested Foreign Master’s and Doctoral Graduates from US Universities.** With rising shares of foreign students, especially in S&E fields, and increasing global competition for international students, it makes less sense than ever to prevent foreign high-skilled students, educated in America, usually supported by US tax-benefited university scholarships, from obtaining employment in the United States. The current situation is such that the 20,000 H-1B visas available for FY2008 were exhausted on May 4, 2007—i.e., prior to university graduations this year. Unless a foreign student graduating in 2007 has one year of optional practical training (OPT) available, he or she will be effectively barred from seeking employment in the US for-profit sector.<sup>2</sup> Interested foreign recipients of master’s and doctoral degrees from US universities with a US employer petitioning on their behalf should be guaranteed access to an H-1B visa.

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1. In April 2007 Senators Durbin and Grassley sensibly suggested giving “the DOL the ability to conduct random audits of any company that uses the H-1B program, and would require DOL to conduct annual audits of companies with more than 100 employees that have 15% or more of those workers on H-1B visas.” See Durbin and Grassley Introduce First Bipartisan H-1B Visa Reform Bill to Protect American Workers, April 2, 2009, available at <http://durbin.senate.gov>.

2. See USCIS press release, USCIS Reaches Exemption Cap for Fiscal Year 2008, May 4, 2007, available at [www.uscis.gov](http://www.uscis.gov).

**Restrict the Share of Foreign High-Skilled Workers that a Single Business Entity over a Certain Size Can Employ on Temporary Work Visas—i.e., Including Both H-1B and L-1—to a Sensible Level.** The H-1B and L-1 programs were designed to allow US employers to identify foreign high-skilled workers and bring them to America, as economic circumstances dictated, to supplement resident workers. This policy analysis has established that instead a very small number of Indian and US IT services/software companies seem to use these temporary work visa programs as a way to sustain an on-site delivery model in the United States, overwhelmingly staffed by foreign high-skilled workers in the IT services/software sector. While perfectly legal, this use of the H-1B and L-1 visa programs is scopewise unintended. In order to politically safeguard these programs for their original beneficial and increasingly necessary economic function, this novel use should be curbed. Such actions of a handful of IT companies, though completely legal, must not hold the entire US high-skilled immigration debate hostage. These actions can be curbed, for instance, as suggested by Senators Durbin and Grassley in April 2007, by prohibiting companies with over 50 workers from employing more than a 50 percent share of foreign workers on H-1B, or L-1, work visas.<sup>3</sup>

Such a restriction would affect only a very limited number of Indian and US IT services/software companies and not concern any major household US IT company. Moreover, as stated by Tata Consultancy Services head of global human resources S. “Paddy” Padmanabhan, in a May 2007 interview with technology weekly *InformationWeek*,<sup>4</sup> 99 percent of the company’s high-skilled workers on temporary H-1B visas leave the United States upon visa expiry, rather than pursue a green card. This indicates that limiting the number of temporary visas available to this group of IT services/software companies will not jeopardize the flow of high-skilled workers seeking permanent US residency.

**Strike a Bilateral Immigration Agreement with India and Create a New Visa Category for Workers in the IT Services/Software Sector.** Undoubtedly, the above proposal to restrict the share of foreign high-skilled workers that any but the smallest company can hire will, based on firm-level data presented in this policy analysis, disproportionately affect Indian IT

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3. Senators Durbin and Grassley suggested that the threshold be 50 workers, and 50 percent of the workforce could be on H-1B visas alone and not include L-1 visas. See Durbin and Grassley Introduce First Bipartisan H-1B Visa Reform Bill to Protect American Workers, April 2, 2007, available at <http://durbin.senate.gov>.

4. See Chris Murphy and Marianne Kolbasuk McGee, “Majority Of U.S. Staffers At Indian Outsourcers Are On H-1B Visas,” *InformationWeek*, May 15, 2007, available at [www.informationweek.com](http://www.informationweek.com).



services companies and Indian nationals.<sup>5</sup> Via their intensive use of the L-1 and H-1B visa programs to sustain their on-site delivery business models, these companies are benefiting from a novel way to utilize the current US temporary high-skilled immigration system. However, as already mentioned, this benefit has accrued to Indian IT services/software companies and their US clones largely though a new, unintended, and—crucially—politically unsustainable use of these US high-skilled visa programs.

Considering that the US market accounts for up to two-thirds of Indian IT exports, worth up to \$10 billion in 2007,<sup>6</sup> the present level of access to temporary US high-skilled visas is of substantial value to the Indian economy. In some respects, this benefit has been at least partly acquired by legally gaming the existing US temporary high-skilled immigration system, indirectly at the expense of other potential US-based users of available visas. The US Congress should overcome jurisdictional turf wars between trade negotiators and immigration officials<sup>7</sup> and realize the negotiating value temporary high-skilled work visas hold today in negotiations with India. In return for appropriate Indian policy concessions—for instance, as a major pillar in a US-India free trade agreement (FTA)—the United States should agree to establish an entirely new visa category—say, “IT visa”—that would be applicable to high-skilled Indian workers in computer-related occupations.

An IT visa for Indian nationals would follow a string of bilateral deals made by US trade negotiators concerning high-skilled visas in recent years. Australia got an annual quota of 10,500 high-skilled E-3 visas as part of its FTA negotiations with the United States.<sup>8</sup> Chile<sup>9</sup> and Singapore got quotas of 1,400 and 5,600 H-1B visas, respectively, of the annual 65,000

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5. It should be noted that many of the main Indian IT companies—Tata Consultancy Services, Infosys, and Wipro being the three biggest—are currently recruiting increasingly aggressively across the world, including at US campuses. As such, their stated business strategies to become truly global multinational companies will at the same time gradually make them less dependent on Indian nationals in their workforces. These companies have grown rapidly from their Indian bases in just the last decade. Turning into truly global services companies—say, like IBM—will take time but nonetheless will gradually make them less dependent on US work visas and other “export markets” for Indian nationals.

6. Data are from NASSCOM (2007). Much uncertainty surrounds the precise dollar level of Indian IT services exports, but what is not in doubt is that the United States is India’s largest market.

7. See, for instance, the May 2005 letter from then House Judiciary Committee Chairman F. James Sensenbrenner, Jr. and Ranking Member John Conyers, Jr. to then US Trade Representative Robert Portman, insisting that the administration not include immigration provisions in trade deals that require changes in US laws (*Inside US Trade*, June 1, 2007, 3).

8. See US embassy in Australia, “E-3 Visas,” <http://canberra.usembassy.gov>.

9. See US embassy in Chile, “Nonimmigrant Visas,” <http://santiago.usembassy.gov>.



quota as part of their FTAs with the United States. Canadian and Mexican citizens, as part of the North American Free Trade Agreement (NAFTA), became eligible for work in the United States as nonimmigrant NAFTA professionals,<sup>10</sup> provided that their profession is on the NAFTA list of eligible professions and that they possess the required skills.<sup>11</sup> A bilateral high-skilled visa agreement with India, however, would be “the big one” and carry a correspondingly large bargaining-chip significance in any potential US-India FTA negotiations.

An IT visa for Indians would be an appropriate response to the on-site delivery business model pioneered to scale by Indian IT services/software companies. It would further be a partial recognition of the new international factor mobility in the services sectors, initially indicated by the General Agreement on Trade in Services (GATS) mode 4—the cross-border supply of a service by a country’s service suppliers through the presence of natural persons in the territory of another country. Quite a large literature exists on the broader topic of the “GATS visa,” which would presumably be multilateral in nature and horizontal—i.e., cover all services sectors.<sup>12</sup> In 2003 14 developing countries, including India, submitted such a proposal for liberalizing mode 4 as part of the GATS negotiations.<sup>13</sup>

This proposed bilateral US-India IT visa would be far more limited in nature and cover only Indian nationals with at least a bachelor’s degree and employed at prevailing US wages at a company with a contract to perform IT services/software-related work in the United States. It would be open to both employees at contractual service suppliers and independent professionals. Such a visa would be temporary only and perhaps be valid initially for up to two years and renewable as required.

More broadly, it seems clear that trade relations via mode 4—i.e., through the on-site delivery model—will increasingly spread to other sec-

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10. See US Department of State, “Mexican and Canadian NAFTA Professional Worker,” <http://travel.state.gov>.

11. See NAFTA website for complete list of eligible occupations and required skills at [www.nafta-sec-alena.org](http://www.nafta-sec-alena.org). It has also been suggested that Korea, as part of the final negotiations of its FTA with the United States, should seek an H-1B carve-out similar to that of Chile and Singapore. Its outcome is, however, at present unknown. See *Inside US Trade*, June 1, 2007, 3.

12. For an overview of this literature, see, for instance, the conference papers from the two World Trade Organization (WTO)-hosted conferences in Geneva in 2002 and 2004: Movement of natural persons (mode 4) under the GATS, Joint WTO–World Bank Symposium, Geneva, April 11–12, 2002; and Managing the Movement of People: What can be learned for Mode 4 of the GATS? Joint IOM/World Bank/WTO Seminar, Geneva, October 4–5, 2004, available at [www.wto.org](http://www.wto.org).

13. See WTO document TN/S/W/14, July 3, 2003. The 14 participating countries include most of the potential large origin countries for high-skilled service-sector workers: Argentina, Bolivia, Chile, China, Colombia, Dominican Republic, Egypt, Guatemala, India, Mexico, Pakistan, Peru, Philippines, and Thailand. Available at <http://commerce.nic.in/trade>.

tors than IT services. It would therefore be fortuitous if US immigration laws moved in a direction that gradually facilitated this trend.

The proposed “IT visa” would not—unlike the L-1 and H-1B visa categories—have a dual intent clause, and hence it would not be possible for “IT visa” holders to apply for US legal permanent resident status while inside the United States on this visa status. Hence it would facilitate Indian nationals to return to India upon visa expiration and pave the way for the formation of a sustained “brain chain” (not brain drain) of talent exchange between the United States and India. Given the serious skilled-labor constraints indicated by the rampant IT skilled-worker wage inflation in India, such a “brain chain” will make this visa agreement more valuable to India by preventing large-scale IT skills hemorrhaging. As such, the proposed IT visa will be in direct accordance with the mandate of the Indian government’s High Level Committee on Indian Diaspora, which since 2003 has been tasked with “facilitating diaspora interaction with India and their participation in India’s economic development.”<sup>14</sup>

The main concerns of any business-oriented visa are generally transparency, expediency, and minimal burdensomeness, yielding a visa-wise predictable business environment for companies. Such predictability is definitely required in the IT services industry, where flexible, timely on-site delivery capacity is an important competitive parameter. Hence, the use—as in other bilateral US visa agreements—of quotas must be completely avoided. The number of available US-India IT visas would be uncapped but instead carry an explicit price tag per visa.

Considering that this policy analysis has shown how IT companies today routinely spend millions of dollars each quarter to secure an adequate number of H-1B and L-1 visas, it would not seem far-fetched, in return for guaranteed (limiting the need for immigration lawyers) and expedient (say, a two-week maximum processing time) high-skilled visa issuance, to put the price in the \$7,500 to \$10,000+ range per high-skilled IT visa.

From such an IT visa, Indian businesses and nationals would gain assured access to the US market. Indeed, the president of India’s National Association of Software and Service Companies (NASSCOM), Kiran Karnik, has pleaded several times for precisely this type of visa.<sup>15</sup> Visa revenue from this IT visa could be directly channeled to improving retraining opportunities for US workers—as is being done in the H-1B visa program via retraining fees. At the same time, the “visa markup” applied to high-skilled Indian IT workers’ prevailing wages would insulate similarly skilled US software workers against displacement. Lastly, the DOL would

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14. See the mandate of the High Level Committee on Indian Diaspora at <http://indiadiaspora.nic.in/mandate.htm>.

15. See Karnik’s comments in “Nasscom Moots Visas for Onsite Assignments,” *Hindu Business Line*, April 27, 2003, available at the NASSCOM website, [www.nasscom.in](http://www.nasscom.in).

enforce the IT visa in a manner similar to the regular H-1B program.

**Regularly Publish Official Firm-Level Immigration Data and Detailed Data on the Characteristics of All High-Skilled Immigrants.** High-skilled immigration should be driven by an economy's skill requirements and the characteristics of both the employers and the high-skilled immigrants themselves. For high-skilled immigration to occur as seamlessly as possible, a high level of transparency is in the public interest. This need for transparency is accentuated by the privileged immigration status granted to high-skilled immigrants relative to other immigrants, as well as by the need to frequently dispel populist and protectionist misrepresentations of the scale, character, and impact of high-skilled immigration.