

# The Information Technology and Innovation Foundation

## Global Flows of Talent: Benchmarking the United States

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November 17, 2006

*Public policymakers around the world are waking up to the talent imperative, especially in the science, technology, engineering and mathematics fields. Yet at a time when many other nations are making it easier for talented immigrants to enter their country...the United States is struggling to decide what to do.*

Economic prosperity depends now more than ever on the continual generation of new ideas as well as the conversion of those ideas into profitable products/services and higher-productivity processes. Countries aspiring to a higher standard of living must not only take part in the newest industries that flow from technological breakthroughs, they must also infuse all their industries with innovation in order to generate and sustain a competitive advantage. To do so, they have to have people with the right skills, educational background, and talent.

Not surprisingly, public policymakers around the world are waking up to the talent imperative, especially in the science, technology, engineering and mathematics (STEM) fields. Yet at a time when many other nations are making it easier for talented immigrants to enter their country, either as students or workers, the United States is struggling to decide what to do. We have sent out mixed messages to the rest of the world since September 11, 2001, and in the immigration debate of the past year, pragmatic discussion has been drowned out by heated rhetoric about other aspects of immigration.

This policy brief benchmarks flows of highly-skilled and highly-educated people to the United States against similar flows to seven other high-income countries: Australia, Canada, France, Germany, Japan, New Zealand, and the U.K. The brief then compares how national immigration policies – permanent, temporary, and student – foster or constrict these flows. All seven nations in the comparison group are liberalizing their immigration policies for the highly-skilled, although some more than others. Finally, we suggest several broad policy recommendations that the United States should consider to ensure that we not only compete effectively for talent in the short-term, but also lead the world toward a global system for developing and using talent that is beneficial for everyone over the long-term.

## **Talent Flows: What They Are and Why They Matter**

The most essential resource in the global knowledge economy is talent. People with good ideas and valuable skills, especially in high-technology fields, are increasingly able to draw resources to themselves. Corporate R&D funding and venture capital are less rooted in particular places than they used to be. Global supply chains hungrily search the world for better mousetraps. Internet-based business models can be implemented from almost anywhere. “Talent,” wrote *The Economist* in a recent survey “has become the world’s most sought-after commodity.”<sup>2</sup>

Talented people are drawn to one another and increasingly capable of joining new communities in other nations. The best ideas are often the hardest to put into words; sustained face-to-face contact is required to share them. However, once a connection is made, these ideas are not simply added together – they multiply. Just as a telephone network grows in value as more people join it, so it is with knowledge exchange.

Policy makers around the world are addressing the need to improve their talent pools in a number of ways, especially through education reform. But education reform is slow, expensive, and difficult. Unfortunately, its only predictable result is political conflict among deeply dug-in stakeholders. Migration of the already educated may provide a short-term fix. While the domestic pipeline in STEM and other critical fields slowly adjusts, one hopes, to the new opportunities and new

demands of the knowledge economy, foreigners can fill the gap.<sup>3</sup>

Indeed, immigrants and visitors may do more than merely fill the gap: by contributing new perspectives and knowledge drawn from other places, such visitors enhance a nation’s creativity. Foreign-born and foreign-educated scientists and engineers in the United States, for instance, are over-represented among authors of the most cited scientific papers and inventors of highly-cited patents.<sup>4</sup> Entrepreneurs born in China and India ran 29 percent of Silicon Valley companies started between 1995 and 1998.<sup>5</sup> “Brain circulation,” as UC-Berkeley’s AnnaLee Saxenian has called this process, allows the United States to dip deeply into the burgeoning pools of knowledge and skills beyond our borders. The result is more innovation and prosperity both here and in the world at large.

In addition to bringing their ideas here, immigrants may become “nodes” in knowledge networks, facilitating virtual and face-to-face relationships with colleagues abroad. Rather than the “melting pot” of the industrial era, the information age rewards the “mixing bowl” approach to migration, in which each new “ingredient” retains its own “flavor,” even as it adds to the value of the whole.

## **The Numbers: Where Highly Skilled Immigrants Are Going**

Assessing flows and stocks of highly-skilled immigrants around the world is difficult. In fact, we do not really know where the world’s most creative and

highly-skilled people are going and how long they are staying in a particular nation. In part, that is because human talent is an intangible quality that intrinsically resists measurement. Would one have been able to predict that college drop-outs like Bill Gates and Steve Jobs would drive the creation of the key technology-based industry of the late twentieth century? The precise reasons why the spark of human potential bursts into flames will always be elusive. Nonetheless, we can make some informed guesses about what kinds of people are most likely to make a difference in the knowledge economy. They will tend to be highly-educated and in demand by employers and educational institutions.

Even these less ethereal attributes, however, are difficult to measure, particularly on a consistent cross-national basis. Some important advances in measurement have been made recently, thanks to the efforts of researchers working with international organizations such as the Organization for Economic Cooperation and Development (OECD) and the World Bank. They have employed two basic sources. One is national censuses, in which respondents state their place of birth and educational level. The other is the records of national immigration and border control services. Each source has strengths and weaknesses. Broadly speaking, the census data are more reliable, but they are gathered less frequently and use cruder categories in some respects than the immigration data.

The census data show that the population of highly-educated foreign-born residents of the United States dwarfs that

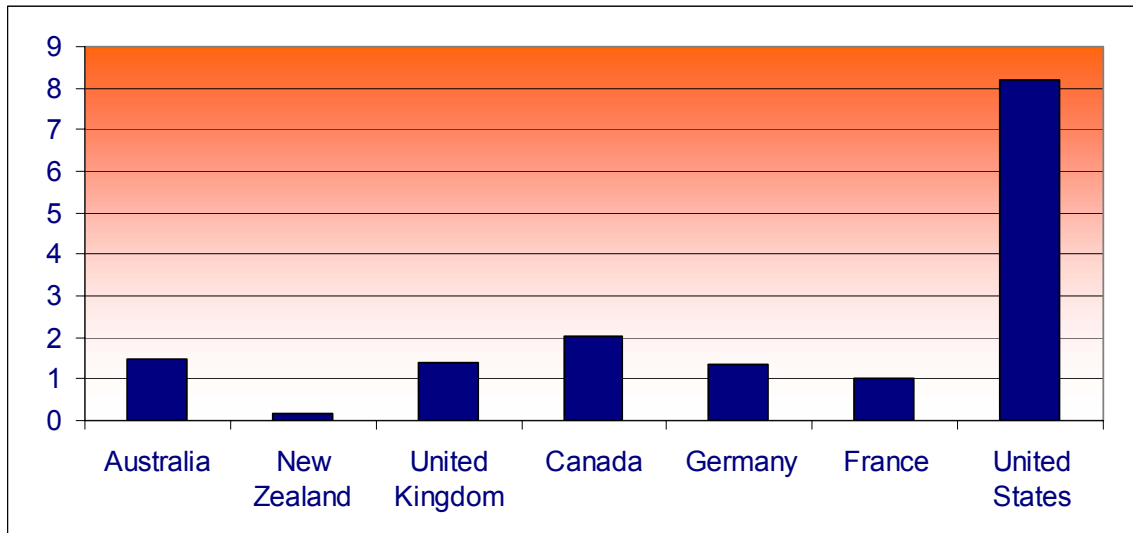
of any other country. In 2000 the United States had more such residents than the other seven countries considered in this brief combined. However, if one looks at recent trends in the immigration data, the picture looks different. The relative sizes of these populations are changing slowly, but noticeably, each decade.<sup>6</sup>

### *Populations of Highly-Educated Foreign Born Residents*

One source of information on highly-skilled immigrants is the national census.<sup>7</sup> According to the 2000 census, there were approximately 8 million foreign-born, college-educated persons in the United States. Canada had the second largest such population, with just over 2 million. (See Figure 1.) Of course, the U.S. population is far larger than Canada's, so it might be argued that the appropriate benchmark is the number of such residents as a share of the nation's population. By this standard the United States (at just under 3 percent) ranks below Australia (about 8 percent), Canada (7 percent), and New Zealand (4.5 percent).<sup>8</sup> (See Figure 2.) These nations, as we will see below, have aggressively sought out highly-skilled immigrants, and the results of their policies are evident in these data.

Fewer countries collect census data about doctoral degree holders – in our group only the United States, Australia, and Canada did so. These data show a similar pattern. The U.S. population of foreign-born Ph.D.s is larger in absolute terms, but smaller in relative terms. The foreign-born Ph.D.-holding fraction of the national population is about four times higher in Australia than in the United States and one and a half times as high in Canada as in the U.S.<sup>9</sup>

**Figure 1: Highly-educated foreign born residents (millions)<sup>10</sup>**



### ***Immigration of Permanent Residents***

Of course, the global migration situation has changed since 2000, and we will probably have to wait until 2013 before the 2010 censuses reveal what the consequences have been for high-skill migration. In the meantime, though, we can get some indication from data gathered by the agencies that determine who should come into each country. These data are generally published annually, and they appear to be quite precise.<sup>11</sup> The problem is that they are precise in ways that are not always helpful for understanding the flow of talent.

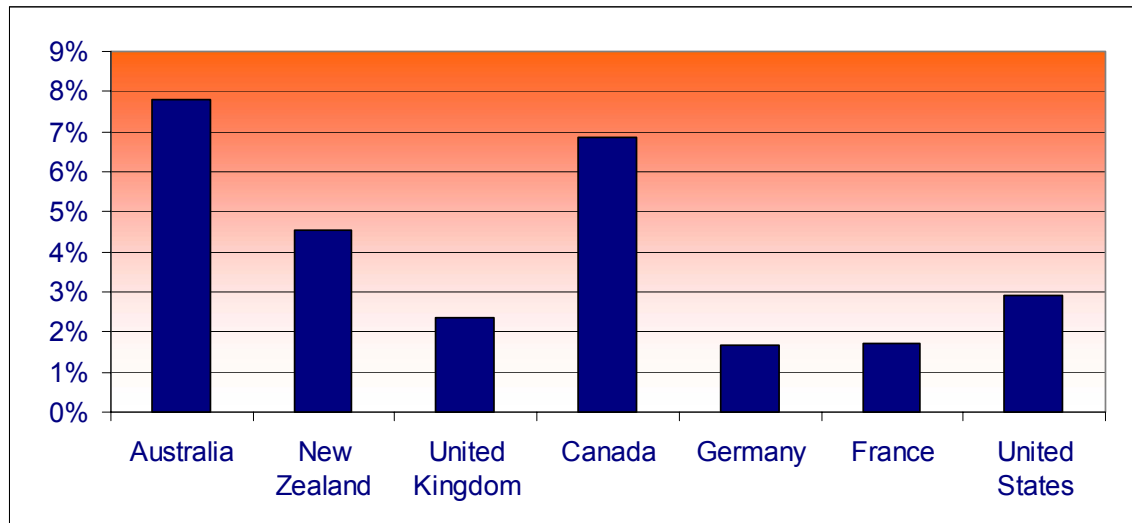
In particular, immigration authorities do not necessarily classify newcomers according to their skill, experience, or educational level. Some immigrants come to work, and some countries sort these immigrant workers according to skill. However, many immigrants come to join family members or for political reasons; some of these immigrants are highly-skilled, but we do not know how

many, because it is not relevant to their applications for admission.

In 2005, for instance, the United States permanently admitted more than one million immigrants. Of these, 22 percent fell into work-related categories. We do not know what fraction of the other 78 percent have skills which are desired by employers. To add to the problem, slightly more than half of the 22 percent sponsored by employers were spouses and children of the principal applicants. For the United States, then, we are able to say something relatively firm about the talents of only about 11 percent of all permanent immigrants last year. That is more than we can say about Europe or Japan; comparable data are only available for Australia, Canada, and New Zealand.

Using these data for the five most recent available years, the United States received an average of about 67,000 highly-skilled permanent immigrants per year,<sup>12</sup> with Canada receiving 56,000 per

**Figure 2: Highly-educated foreign-born/total population as share of total population<sup>13</sup>**



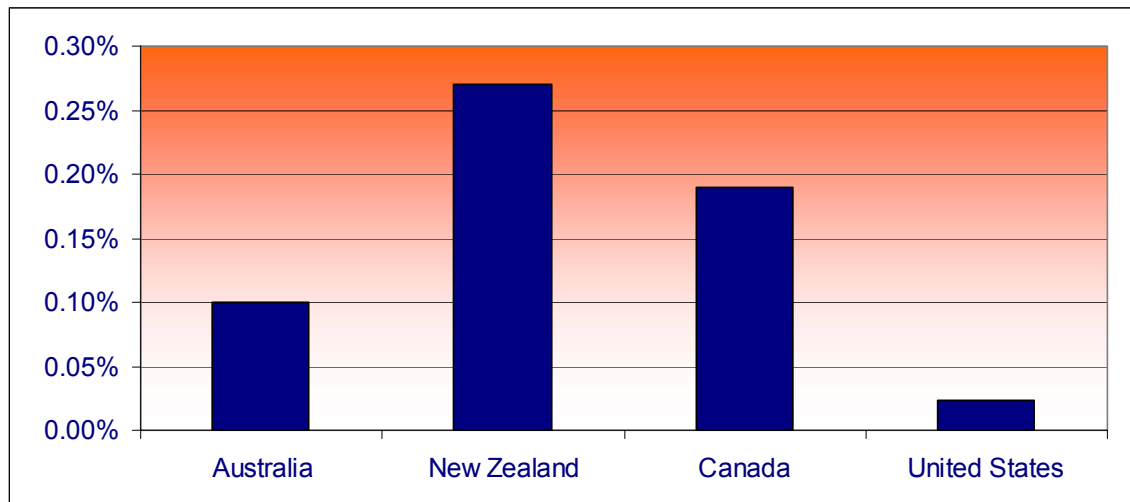
year, Australia 20,000, and New Zealand, about 10,000.<sup>14</sup> (See Figure 3.) As a share of their populations, these rates are all several times larger than those in the United States – more than 11 times larger in the case of New Zealand.

Of course, highly educated people leave these nations, too. A World Bank data set that includes information from 1990 provides a glimpse of the moving picture of these populations over time. It shows that more highly-educated people left Canada in the 1990s than left the United States in that decade, the population difference notwithstanding. The emigration rate for Canada was thus more than 10 times that of the United States. Australia's was nearly 7 times

that of the United States, and New Zealand's, over 50 times.<sup>15</sup>

In the 1990s, the U.S. Internet boom exerted a particularly powerful pull on talented people from around the world, so we may not want to place too much stock in this single frame of the film. Still, it suggests that the skill-oriented policies of the smaller English-speaking countries have a Red Queen aspect to them – they have to run harder just to stay in the same place, although in this case they are probably running fast enough to move forward. Among the eight countries considered here, only Japan exerted a stronger hold on its highly educated population than the U.S. – quite a testament to the country's appeal to its natives, given its poor economic record in the 1990s.

**Figure 3: Annual inflows of highly skilled as share of total population<sup>16</sup>**



### ***Temporary Migration for Highly-Skilled Workers***

It is equally difficult to get good comparative data on temporary migration of highly-skilled workers.<sup>17</sup> We were only able to gather roughly comparable data for the United States, Australia, and Canada. They reveal a very different picture from the data on permanent immigration. While the other nations have concentrated on bringing in the highly-skilled on a permanent basis, the United States' focus has been on temporary work. The United States makes over a million temporary admissions for visa classes that are likely to be comprised predominantly of long-term highly-skilled workers, including academic exchange visitors,<sup>18</sup> compared to only about 40,000 annually in each of the other two nations.<sup>19</sup> The U.S. flow is higher not just in absolute terms, but also in per-capita terms.

### ***Foreign University and Graduate Students***

The data on foreign students are much better than on high-skill migration.

However, estimating their economic contributions presents a greater challenge. Not all students work, and not all of those who do work use their skills or education. On the other hand, they may contribute indirectly to innovation merely by being good students and research assistants and motivating their teachers. More important, students comprise an attractive population of potential immigrants and are increasingly given special preferences to this end. However, if they did start to work on a full-time basis, they would generally be counted as permanent or temporary immigrants, so it is important not to double-count them.

The ability of the United States to attract foreign students appears to be deteriorating. The flow of students to the United States declined by about 70,000 per year after 2001, or some 25 percent, and rose elsewhere. (See Figure 4.) On average between the years 2000 and 2004 the United States received about 31 percent of the total, which is

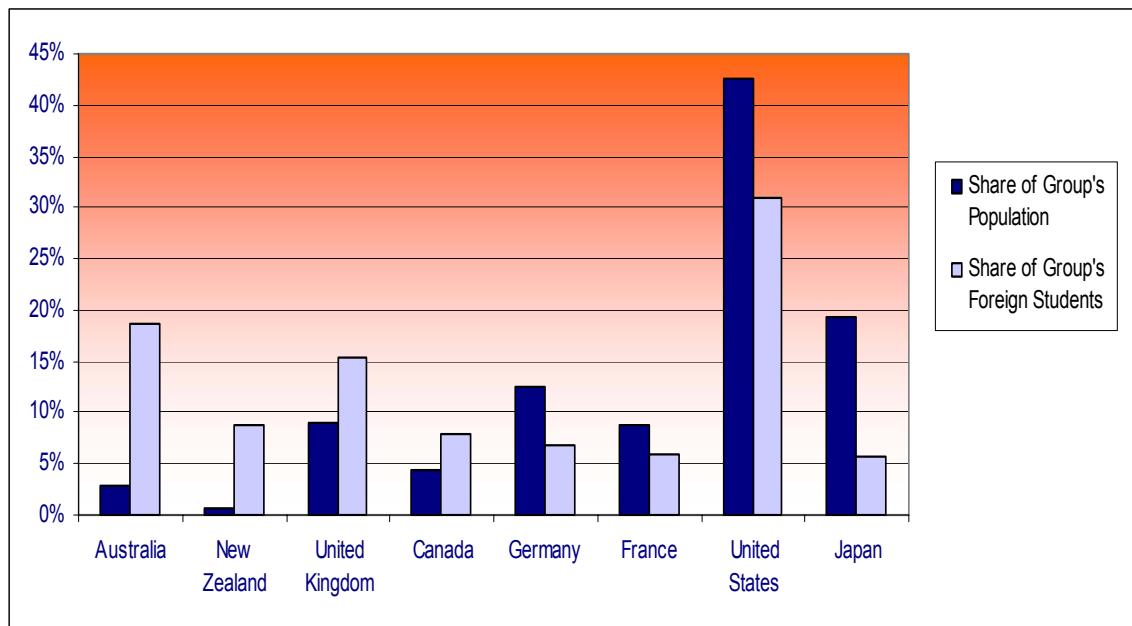
substantially less than its 43 percent share of the combined population of the eight countries. Australia received almost 19 percent of all foreign students among the eight countries, even though it only contains 3 percent of the combined population. New Zealand also receives an outsize flow (9 percent vs. less than 1 percent) as do the U.K. (15 percent vs. 9 percent) and Canada (8 percent and 4.5 percent).<sup>20</sup> Like the United States, France, Germany, and Japan receive fewer students than their population size would suggest, although the numbers for France and Germany have grown substantially since 2000.<sup>21</sup>

The home countries of foreign students vary significantly. According to the Institute of International Education, China is the only home country that provided 5 percent or more of the

foreign students in all eight countries in 2004. It is the largest in five nations, including Australia (where Chinese students comprise 27 percent of the foreign student population), Germany (10 percent), Japan (65 percent), New Zealand (60 percent), and the U.K. (15 percent). For American universities, however, India is the largest foreign source of students (14 percent), with China supplying 11 percent of the U.S. foreign student population.<sup>22</sup>

For those accustomed to thinking of the United States as the dominant player in the global higher education “industry,” these data may come as a surprise. They should reinforce an emerging picture of global high-skill migration in which other nations, such as Australia, Canada, and New Zealand, play a bigger role than they used to.

**Figure 4: Comparative foreign student population by nation<sup>23</sup>**



## Jockeying for Position: High-Skill Immigration Policy Trends<sup>24</sup>

The migration decisions of highly-skilled people are shaped by many factors – economic, social, and psychological. The immigration policies of the receiving countries are an important factor, but not the only one. On the whole, these policies serve as a constraint on migration flows. Within this context, in which the demand to immigrate is greater than the supply of visas, the eight nations appear to take three broad approaches.

The first group – Australia, Canada, and New Zealand – conceive of immigrants as a source of economic growth and consider highly-skilled immigrants to be especially valuable contributors. These nations have long-standing immigration policies that favor the highly-skilled, which they continue to refine. They typically seek to have the highly-skilled and highly-educated comprise 50 percent or more of total permanent immigration; the most recent figure for Australia was 65 percent.<sup>25</sup>

These nations implement their policy in favor of high-skill immigration through point systems. Applicants for immigration receive points for such characteristics as education, work experience, and language skills. Those surpassing an adjustable point threshold are admitted. Having a job offer in hand and meeting a designated occupational shortage may add points to an individual's application, but it is usually possible to meet the pass mark without either of these attributes.

The second group – the U.S. and U.K. – are generally open to immigration but do

not put high priorities on tilting the mix of immigrants toward the talented. By virtue of their central positions in the world economy and global politics, these countries have historically received large streams of immigrants of all skill levels without necessarily trying too hard to do so. However, the U.K. has begun to take a more strategic perspective in recent years, moving in the direction of its smaller former colonies and emphasizing skills and education. The United States sporadically debates whether to shift toward a stronger focus on high-skill immigration, but it has not maintained a consistent, coherent policy.

The third group – France, Germany, and Japan – tends to view highly-skilled immigrants, like immigrants in general, more as threats to native workers than as positive additions to national well-being. Some French, German, and Japanese leaders, responding to global economic competition and the aging of their native populations, have tried in recent years to change both this public perception and the restrictive policies that flow from it. Their efforts have met with substantial opposition, and change has been slow at best. However, they have been successful in modestly liberalizing immigration of select groups of professions, such as information technology specialists and health care providers, and foreign students.

The great exception to this generalization is the European Union, of which France, Germany, and the U.K. are members. One purpose of the EU is to facilitate economic integration, including labor mobility, among the member states. Citizens of one member state can generally work in another without restriction.<sup>26</sup> About 2 percent of Europeans live outside their

native land and perhaps a third of these are highly-skilled.<sup>27</sup> The EU has a variety of programs to facilitate such mobility. For instance, it is seeking to create a unified labor market for European scientists, supported by a new basic research funding agency called the European Research Council (ERC).

In all eight countries, immigration in general is a contentious and increasingly central issue in national politics. Countries in which highly-skilled immigrants are perceived by electorates as different from and better than other immigrants are more likely to develop targeted policies that favor them than those in which the highly-skilled get lumped in with all other foreigners.

### ***Trends in Permanent High-Skill Immigration Policies***

Even though they already have liberal policies toward highly-skilled immigrants, Australia, Canada, and New Zealand have continued to tinker with their point systems in recent years, with Canada making the most significant adjustments. In its 2002 reform, Canada sought to create a more flexible system by, among other things, eliminating the awarding of points for meeting an occupational shortage, on the basis that it was difficult to specify, track, and designate shortage occupations. The new system places greater weight on education, language ability, and experience. New Zealand moved in the opposite direction in 2004 and again in 2006, awarding additional points on the basis of occupational shortages. All three countries have also sought to reduce red tape and delays in processing applications.

The U.K. put a point system in place for the first time on a pilot basis in 2002. The

Migration Policy Group describes this system as “fundamentally different” from the previous policy, because applicants need not have a job offer to win admission.<sup>28</sup> In 2004, 7,000 people were admitted under this program, out of some 100,000 work-related immigrants. Building on the pilot program, the British government has proposed a broad overhaul of employment-related immigration policy. The likely effect of this reform will be to increase the number of skilled immigrants.

No serious proposals for a point system have been advanced in the United States. Currently, an employer must sponsor an applicant for an employment-preference green card, of which about 140,000 are currently available each year. The Senate immigration bill this year proposed to raise this cap to 290,000.<sup>29</sup> Since most of those who receive this type of green card are highly-skilled, approval of this provision would likely expand the flow of such immigrants substantially.

The Internet boom produced a flurry of high-skill immigration policy activity in France, Germany, and Japan, as leaders in these countries perceived skill shortages and declining competitiveness in the “new economy.” Most of this activity involved temporary migration and is discussed below. However, an independent commission in Germany did recommend that the country adopt a point system and admit 20,000 people per year permanently under it. The proposal was confronted by severe political obstacles. The law that eventually came into force in 2005 provides the possibility of permanent residence only for a few narrowly defined professions, such as scientists and teachers. France has put a similar policy in place. Japan has not seriously considered a

program for permanent immigration of any magnitude.

### ***Trends in Temporary High-Skill Immigration Policies***

When it comes to temporary, as opposed to permanent, high-skill migration, the stated policies of all eight countries have much in common. They typically allow skilled foreigners with a job offer in hand from an employer to work for several years. The employers and employees are usually required to meet labor market standards in areas such as pay and qualifications. However, there are significant variations in how these policies work in practice. Perhaps the most crucial factor distinguishing the English-speaking countries from the European countries and Japan is that in the latter labor ministries apply the labor market standards and are generally more restrictive in their interpretation than other ministries.

In Australia and New Zealand, immigration ministries appear to have a major role in managing the process. Employers in these countries may negotiate a prior accreditation with the government that permits recipients of their job offers to get work permits automatically. The U.K. eased its administrative system for temporary work permits in the 1990s, more than doubling the number issued in the second half of that decade. Canada's policies toward temporary high-skill immigration provide a contrast to its liberal approach to permanent immigration. According to a Canadian government assessment, it is "lagging behind" other English-speaking countries due to its "slow and cumbersome validation" process, despite making major changes in 2002.<sup>30</sup>

In the United States, H-1B visa applicants must be approved by the Department of Labor, but this determination is made largely on the basis of an attestation by the employer, rather than through an independent analysis by the Department. A more stringent limit on the H-1B category is a numerical quota set by Congress, which has fluctuated dramatically in recent years and currently is far below employer demand.<sup>31</sup>

In contrast, France and Germany vest more authority in their labor ministries, with the result that rejection of applications on the basis of adverse impact on the labor market is more likely. A 2003 report on France by the Migration Policy Group stated, for example, that applications are "systematically rejected."<sup>32</sup> "Work immigration to France," the authors concluded "is still impossible today." However, France and Germany have recently carved out modest exceptions to this administrative process for specific high-skill professions, such as those related to scientific research, creating a "fast track" for a small number of applicants.<sup>33</sup> Moreover, France's controversial June 2006 immigration bill included a new three year "skills and talents" residency permit.

Japan, too, has put forward plans to facilitate temporary high-skill migration, but these appear to be stymied in practice by administrative procedures. In 2002, according to the OECD, 123,000 of the 145,000 foreigners residing in Japan primarily for employment reasons were entertainers. Japan's Minister of Science and Technology recently once again stated the government's commitment to a "targeted reform of immigration control" concluding "Researchers of the world, come to Japan to work with us. We will

wholeheartedly welcome you!”<sup>34</sup> Some skepticism is warranted as to whether the Minister will be able to make good on this invitation.

### *Trends in Foreign University and Graduate Student Policies*

Although in most cases, the permanent and temporary immigration policies outlined above fix the size of the immigration pipeline, foreign students are increasingly viewed as well-qualified, well-integrated applicants with whom that pipeline ought to be fed.

Students completing degrees in Australia, Canada, and New Zealand receive points toward permanent status, should they seek it. In Canada and New Zealand recent graduates are now permitted to seek skilled work and to take it for up to two years if they find it.<sup>35</sup> The U.K. introduced a program in 2004 that allows science and engineering graduate degree recipients to work there for a year. Australia is more restrictive, but it does let recent graduates with the means to support themselves stay for an extra year after they finish. These transitional statuses allow former students to demonstrate their value as employees and as members of society and give them a leg up should they seek work visas.

French, German, and Japanese employers have all received official encouragement to recruit employees among their foreign student populations in recent years. Recent foreign graduates in Germany, for instance, may receive a one-year visa to look for skilled work, although permission for them to work is subject to the same controls as any other foreign worker. In Japan, they can legally search for work for six months. France’s June 2006 immigration reform also included

provisions easing the transition for non-EU residents seeking to move from school to work.

In contrast, the United States has no formal transition process for foreign students to move into the working population, but in practice, many do so. Those who find jobs may be sponsored by their employers to “adjust” to a new status. An estimated one quarter of H-1B visa recipients, according to a 2001 study adjust to that status from a student visa.<sup>36</sup> (About half of all legal permanent immigrants adjust to permanent status from a temporary visa.)

As noted above, flows of foreign students to the United States declined significantly after the terrorist attacks of 2001. Procedures for the acquisition of student visas became substantially more burdensome, including a personal interview at a U.S. embassy or consulate and more rigorous security checks. The resulting delays blocked some foreign students from coming here and discouraged many more.

In the past couple of years, however, the situation has improved. The State Department added 25 new officers to handle interviews in India, where some of the worst backlogs have been, although it still takes more than 30 days to get an interview there.<sup>37</sup> The average time required for an interagency security check declined from 67 days in early 2003 to 15 days in late 2004.<sup>38</sup> Nonetheless, national security considerations still shadow U.S. policies toward foreign students in ways that are less evident (though not necessarily absent) in other countries.

## Implications for High-Skill Immigration Policy in the United States

It is clear from this review that other nations are not standing still in the short-term competition for highly-skilled workers. Just as they have put in place aggressive policies to expand research funding and R&D tax incentives,<sup>39</sup> they have liberalized high-skill immigration policies. As a result, the historic U.S. dominance in innovation and high-skill immigration is being challenged.

The implications of these trends for the United States are two-fold. First, we need to put in place the right policies to ensure that highly-skilled workers and students in the right numbers are able to come to the United States. Second, we need to make sure that this short-term competition does not become a zero-sum game by thinking more strategically about global human capital development over the long-term.

### *Reforming High-Skill Immigration Policies*

The brain circulation argument suggests that U.S. competitiveness in the global knowledge economy would benefit from a continual churning of the talent base through permanent immigration. The appropriate level at which to set this inflow, though, is not obvious. A very rough current estimate is that high-skill immigration now comprises roughly 0.05 percent of the labor force per year.<sup>40</sup> If the employment-preference categories

doubled, as the current Senate bill provides, this flow would double to about 0.1 percent. To put this in perspective, that would be roughly a third of the current churn in Canada. The impact on specific professions, however, could be much greater.<sup>41</sup>

Thinking about permanent immigration in terms of brain circulation provides clearer guidance about how immigrants should be selected than about how many the United States should accept. The current system of employer sponsorship signals only that potential

immigrants are desirable employees. A system that allowed additional criteria to be considered, like those used in the point systems of Australia, Canada, and New Zealand, might meet policy objectives better.

Foreign graduate students in STEM fields might be given special preference within such a system, even if they have not received job offers. A provision in the stalled Senate immigration bill would automatically make recipients of advanced science and engineering degrees eligible for permanent residency. Providing additional opportunities for green cards not tied to employment could allow highly-skilled foreign graduates to make more creative contributions to the economy more quickly by working in smaller and riskier businesses.

Instituting a point system would not necessarily mean restricting employer-based high-skill migration. In fact, under certain conditions, there may be a good case for expansion of some visa categories, particularly for temporary stays. Brain

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circulation should facilitate collaborative work in STEM and other fields. In addition, employers may occasionally face shortages of particular skills, due to long lag times in training and education, which can be alleviated by temporary immigration. At other times, the domestic labor market may be very slack. We need to take care that flows of talented immigrants – particularly on a permanent basis – do not displace and discourage native-born citizens from entering particular fields. Temporary high-skill immigration policy should be flexible enough to adjust to changes in technology and the economy.

Any change in the scale of high-skill immigration should be coupled with sensible reforms. The H-1B visa program, the United States’ largest for temporary work in STEM and related fields, has not responded smoothly to the ups and downs of the knowledge economy in the past decade. Congress might consider delegating more responsibility for administering such programs to the executive branch, including the setting of the annual H-1B quota, with appropriate guidance as to the labor market and other criteria that the implementing agencies should employ. Moreover, if conditions call for expansion, an auction system for some temporary high-skill visas might be considered as a means of allocating them to fields in which demand is the strongest and impact on the economy most beneficial.

Additionally, tighter oversight of the program may be required to ensure that visas are allocated to employers paying prevailing wages. Some employers, including Indian “job shops,” are reportedly paying below prevailing

wages.<sup>42</sup> Better linkages between the Department of Labor’s ES202 series (the regular reports that employers submit on all employees for whom they pay unemployment insurance) and H-1B visa applications would allow easier monitoring and enforcement of wage levels. Visa

programs should only benefit employers who are doing their share to advance American living standards.

Finally, U.S. policy should make it easier for foreign students to attend school here. The U.S. should aim to allow our academic institutions to compete on a level playing field with those of other countries. Maintaining the momentum toward simpler procedures and shorter processing times for student visas, while maintaining adequate security controls, is essential to achieving this goal.

### ***Leading for the Long-Term***

The U.S. position in high-skill immigration remains strong. Many talented people want to come here – more than we have chosen to accommodate. Part of that appeal is cultural, and part stems from the impressive capacity of the U.S. national innovation system to utilize scientific and technological talent effectively, regardless of its source. Our current strength is not an excuse for complacency, for the demand from highly-skilled individuals to come to the United States could easily drop as other

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nations become richer and more developed. At the same time, the United States has both the responsibility and the capability to act on a long-term, global vision: a future in which the global talent pool both circulates widely and expands rapidly, spreading prosperity in the context of greater openness and interdependence.

To that end, we should welcome legitimate competition among nations to appeal to internationally mobile, highly-skilled workers.<sup>43</sup> We will benefit by using the innovations those workers make and the new ideas they generate, wherever they may be located. The notion that there is a “global war for talent” that the United States must “win” is misguided. “War” is a poor metaphor for a process of knowledge-sharing in science and technology that holds great potential to produce large gains for everyone in the world.

We should also recognize that brain circulation can devolve into brain drain. The number of talented people is limited everywhere in the short run, and we should take care to ensure that the countries from which we draw immigrants are nonetheless able to partake of the fruits of the knowledge economy. In particular, the high-income countries together should take care to avoid stripping too much talent from lower-income countries, particularly

smaller countries and especially in areas of critical human need, such as medicine and education. Expanding the talent pipeline, both at home and abroad, is the long-term answer to the “brain drain.” In the short-term, joint action by the receiving countries may be warranted to address this problem.

Properly governed, expanding global flows of talent can and should be a win-win proposition for the U.S. and the rest of the world. Talent is the ultimate renewable resource, and knowledge, the ultimate public good. Policies that facilitate brain circulation and the creation of international networks of talented people from all over the world are essential tools to combat poverty and underdevelopment.<sup>44</sup>

One can hope that the incentives for high-skill migration will eventually have much more to do with creative opportunity and less to do with salary differentials than they do today. In such a world, there would still be a lot of movement as highly-skilled individuals circulate, but each country’s talent “balance of trade” would tend toward zero – even that of the United States. That world is, at best, many decades away. To move us toward it in the meantime, a judicious blend of statesmanship and self-interest is called for from American leaders.

## Endnotes

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<sup>1</sup> The author thanks Dan Correa of the Information Technology and Innovation Foundation for research assistance.

<sup>2</sup> Adrian Wooldridge, “The Battle for Brainpower,” *Economist*, October 7, 2006, survey section, p. 3.

<sup>3</sup> Experts disagree about the adjustment process. It is not clear that the “market” for STEM talent works like other labor markets and that demand will produce an adequate domestic supply response, even with a lag.

<sup>4</sup> Paula E. Stephan and Sharon G. Levin, “Exceptional Contributions to U.S. Science by Foreign-Born and Foreign-Educated,” *Population Research and Policy Review* 20:59-79 (2000).

<sup>5</sup> Annalee Saxenian, “Silicon Valley’s New Immigrant High-Growth Entrepreneurs,” *Economic Development Quarterly* 16:20-31 (2002).

<sup>6</sup> The relative sizes of these populations over time also depend on their demographic profiles. An older population will experience more retirements and deaths than a younger one, for instance. In addition, census data may also capture temporary residents, where the patterns are different, as described later in this section.

<sup>7</sup> Most census agencies gather information from respondents about their place of birth and level of education, but not necessarily about their age upon arrival in the country or their place of education. The categories for educational attainment available for cross-national comparison tend to be simple: the respondent either went to high school, to college, or neither. A 70 year old who arrived from abroad at age 2 and went to a domestic college, but not to graduate school, therefore appears to be identical in these data to a 26 year old who arrived with a foreign doctorate just before the census was taken.

<sup>8</sup> The source for data in this paragraph and associated figures is OECD, *Trends in International Migration (SOPEMI) 2004* (Paris: OECD, 2005), p. 142 and p. 145.

<sup>9</sup> *Ibid.* The challenges of estimating these populations are discussed in further detail in National Science Board, *Science and Engineering Indicators 2006* (Washington: NSB, 2006), p. 3-32.

<sup>10</sup> 2000 U.S. Census; OECD 2005.

<sup>11</sup> Of course, we have little information about illegal immigrants. A reasonable assumption is that very few of them are highly-skilled, although many surely have under-developed talents of potential economic value.

<sup>12</sup> This figure includes all permanent admissions (green cards) based on employment-based preferences, excluding all dependents and all of the following classes: E4, EW3, EW8, and EC6. *USCIS Statistical Yearbooks 2000-2005*, “Immigration by Type and Class of Admission,”

<[www.uscis.gov/graphics/shared/statistics/yearbook/index.htm](http://www.uscis.gov/graphics/shared/statistics/yearbook/index.htm) accessed August 31, 2006>.

<sup>13</sup> 2000 U.S. Census; OECD 2005.

<sup>14</sup> Australian data are drawn from the Australian Department of Immigration and Multicultural Affairs (DIMA) annual *Immigration Update*, <[www.immi.gov.au/media/publications/statistics/](http://www.immi.gov.au/media/publications/statistics/)>, accessed August 31, 2006. New Zealand data are drawn from OECD, *SOPEMI 2006*, pp. 303-304. Canadian data are drawn from Citizenship and Immigration Canada annual *Facts and Figures*, accessible at <[www.cic.gc.ca/english/research/menu-fact.html](http://www.cic.gc.ca/english/research/menu-fact.html)>, accessed August 31, 2006. All figures are for principal applicants only.

<sup>15</sup> Frederic Docquier and Abdesalam Marfouk, “Measuring the International Mobility of Skilled Workers (1990-2000) – Release 1.0,” World Bank working paper 3381, 2004. The raw data are available at Docquier’s website: <[www2.univ-lille2.fr/droit/enseignants/docquier/articles.htm](http://www2.univ-lille2.fr/droit/enseignants/docquier/articles.htm)>. OECD data on expatriates (*SOPEMI*, 2004, p. 125-126) corroborate the World Bank emigration data. These data show that the U.K. also has a relatively high proportion of its highly educated population living abroad. The data do not yet allow us to make precise estimates of the net growth rates of these populations (that is, subtracting emigration from immigration), but it is quite possible that migration added several times as many educated people on a percentage basis to the Canadian, Australian, and New Zealand populations as it did to the United States’.

<sup>16</sup> See footnotes 13 & 14.

<sup>17</sup> Visas for temporary stays usually specify whether or not the recipient can work, which means that we do not have to worry about unmeasured additions to the talent pool through temporary migration like we do on account of the permanent immigration of family members and refugees whose skill levels are unknown.

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However, some countries do not gather data on skill levels even among those admitted temporarily to work. U.S. data-gathering procedures add a further complication. Admissions, rather than individuals, are counted by DHS, so that the same person may be counted more than once. Finally, we do not have data on the length of time these temporary migrants actually stay, which may vary from a few months to several years.

<sup>18</sup> This figure includes the following visa categories: H-1B, H-1B1, J-1, L-1, O-1 and TN. USCIS, *Fiscal Year 2005 Yearbook of Immigration Statistics*, Table 26,

<[www.uscis.gov/graphics/shared/statistics/yearbook/2005/Table26D.xls](http://www.uscis.gov/graphics/shared/statistics/yearbook/2005/Table26D.xls)>, accessed August 31, 2006.

<sup>19</sup> Australian data are drawn from the Australian Department of Immigration and Multicultural Affairs (DIMA) annual *Population Flows* and include Business Long Stay, Independent Executive, and Business Skills categories, <[www.immi.gov.au/media/publications/statistics/](http://www.immi.gov.au/media/publications/statistics/)>, accessed August 31, 2006. New Zealanders are not counted in the Australian data due to a free trade agreement. Canadian data are drawn from Citizenship and Immigration Canada annual *Facts and Figures*,

<[www.cic.gc.ca/english/research/menu-fact.html](http://www.cic.gc.ca/english/research/menu-fact.html)>, accessed August 31, 2006. U.S. citizens are counted in Canadian data.

<sup>20</sup> The data in this paragraph are drawn from country summaries in OECD, SOPEMI 2006.

<sup>21</sup> Student counts may not include flows within the European Union.

<sup>22</sup> Institute for International Education, *Atlas of Student Mobility* <[www.atlas.iienetwork.org](http://www.atlas.iienetwork.org)>, accessed October 10, 2006.

<sup>23</sup> Organisation for Economic Co-operation and Development, *Système d'Observation Permanente sur les Migrations (SOPEMI)*, 2006.

<sup>24</sup> Key sources for this section include B. Lindsay Lowell, "Policies and Regulations for Managing Skilled International Migration for Work," unpublished paper presented at the United Nations Expert Group Meeting on International Migration and Development, 2005; Devesh Kapur and John McHale, *Give Us Your Best and Brightest* (Washington: Center for Global Development, 2005); the OECD's annual SOPEMI, and country reports of the Migration Policy Group.

<sup>25</sup> DIMA, "Fact Sheet 24: Overview of Skilled Migration to Australia," <[www.immigration.gov.au/media/fact-sheets/24overview\\_skilled.htm](http://www.immigration.gov.au/media/fact-sheets/24overview_skilled.htm)>, accessed October 11, 2006. The data are for 2004-05.

<sup>26</sup> An optional transition period to full labor mobility was built into the recent enlargement of the EU. The fifteen older member states have up to seven years before they must open their borders to the citizens of the ten new ones. France and Germany have chosen to use a transition period, while the U.K. decided to open up immediately.

<sup>27</sup> Euractiv.com, "Just What Makes Europeans Move?," updated September 18, 2006,

<[www.euractiv.com/en/innovation/just-europeans-move/article-153775](http://www.euractiv.com/en/innovation/just-europeans-move/article-153775)>, accessed October 11, 2006;

Ettore Recchi, *et al.*, "Pioneers of European Integration 'From Below'," p. 3, and Michael Braun and Camelia Arsene, "The Demographics of Movers and Stayers in the European Union," p. 12, papers presented to the Final PIONEUR Conference Project, March 2006, <[www.obets.ua.es/pioneer](http://www.obets.ua.es/pioneer)>, accessed October 11, 2006.

<sup>28</sup> Annaliese Baldaccini, "EU and US Approaches to the Management of Immigration: UK," (Brussels: Migration Policy Group, 2003).

<sup>29</sup> Yudhijit Bhattacharjee, "Congress Weighs Steps to Retain Foreign Talent," *Science* 312:177 (14 April 2006).

<sup>30</sup> Surendra Gera and Thitima Songsakul, "How Is Canada Faring in the Competition for Internationally Mobile High-Skilled Workers," working paper 2005 D-06, Skills Research Initiative, Industry Canada.

<sup>31</sup> The H1-B quota rose from 65,000 in fiscal 1998 to 195,000 in 2003 before returning to 65,000 in 2004 plus an additional 20,000 set aside for advanced degree recipients. The Senate immigration bill would raise the quota to 115,000 and would increase it by 20 percent each year it is met. The 2007 quota was fulfilled less than two months after applications were opened in April 2006.

<sup>32</sup> Reynald Blion, *et al.*, *EU and US Approaches to the Management of Migration: France* (Brussels: Migration Policy Group, 2003), p. 15.

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<sup>33</sup> In the early 2000s, several countries, including Germany and Japan, set up special programs to facilitate temporary migration by IT specialists. These have generally been terminated now, although some of these professions may have been folded into broader “fast track” programs.

<sup>34</sup> Iwao Matsuda, “Boosting S&T Innovation in Japan,” *Science* 313:1201 (1 September 2006).

<sup>35</sup> In Canada, two years are allowed only if the degree is completed and employment is found outside of metropolitan Montreal, Toronto, or Vancouver; otherwise, the permitted stay is one year.

<sup>36</sup> B. Lindsay Lowell, “The Foreign Temporary (H1-B) Workforce and Shortages in IT,” in Wayne Cornelius, ed., *International Migration of the Highly-Skilled* (La Jolla: UCSD, 2001).

<sup>37</sup> Spencer Ante, “Breaking the Visa Backlog,” *Business Week Online*, April 24, 2006, <[www.businessweek.com/technology/content/apr2006/tc20060424\\_377280.htm](http://www.businessweek.com/technology/content/apr2006/tc20060424_377280.htm)>, accessed October 12, 2006.

<sup>38</sup> Government Accountability Office, “Streamlined Visas Mantis Program Has Lowered Burden...” GAO 05-198, February 2005.

<sup>39</sup> Robert D. Atkinson, “The Research and Experimentation Tax Credit: A Critical Policy Tool for Boosting Research and Enhancing U.S. Economic Competitiveness,” *Information Technology Innovation Foundation*, September 4, 2006, <[www.itif.org/files/R&DTaxCredit.pdf](http://www.itif.org/files/R&DTaxCredit.pdf)>

<sup>40</sup> This estimate uses the same high-skill migration as Figure 3. Only employment-preference immigrants are counted; as the text above notes, these comprise some 11 percent of all permanent immigrants. The U.S. labor force is estimated to be about 150 million people.

<sup>41</sup> A recent projection by B. Lindsay Lowell for the IEEE-USA interprets the Senate bill to allow for a fivefold increase in employment-based preferences, a substantially larger increase than that assumed in the text. Such an increase would lead to levels of immigration over the next decade that could yield a labor force that is well above the level of demand in computing and engineering professions projected by the Bureau of Labor Statistics. B. Lindsay Lowell, “Projected Numbers of Foreign Computer and Engineering Workers Under the Senate’s Comprehensive Immigration Reform Act (S. 2611),” Institute for the Study of International Migration, Georgetown University, August 2006.

<sup>42</sup> Ron Hira, “U.S. Immigration Regulations and India's Information Technology Industry,” *Technological Forecasting and Social Change* 71(8):837-854 (October 2004).

<sup>43</sup> Legitimate efforts include steps such as boosting funding for research, expanding universities, and implementing appropriate intellectual property protections. Illegitimate efforts include steps such as manipulating the standards process to discriminate against foreign technology companies, stealing intellectual property, requiring IP transfer as a condition of domestic market access, and a host of other “mercantilist” practices. (See forthcoming ITIF report on this topic.)

<sup>44</sup> David M. Hart, “From Brain Drain to Mutual Gain,” *Issues in Science and Technology* (Fall 2006).

**About the author:**

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