

ATTRACTING TALENT: LOCATION CHOICES OF FOREIGN-BORN PHDS IN THE US

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In the global competition for talent, workers trained in science and engineering have great allure. They are key inputs in the production of knowledge, with graduates in S&E fields patenting at much higher rates than graduates in other fields, thereby enhancing a country's potential for economic growth. During the last half century, obtaining an advanced degree in science and engineering, especially for individuals from low-income regions, often meant studying in the United States, the country which has produced more S&E doctorates than any other. In 1975, the share of science and engineering PhDs graduating from US universities was 47% of the total among students from major Asian nations and advanced European economies. While this share fell to 25% in 2004, reflecting a broader internationalization of higher education, the United States remains a major location for S&E training.

The population of students pursuing S&E PhDs has globalized, making it common for individuals to study in one country and to work in another. In 2007, students born outside the United States accounted for 53% of US PhDs awarded in S&E fields, up from 21% in 1960. Growth in the foreign-born share of US PhDs has come entirely from low and middle-income countries. Many of these countries are now growing at much faster rates than the United States. Students from emerging and frontier economies who go abroad for advanced training may find it increasingly attractive to return home after completing their degrees. For the 2005 cohort of US PhDs, 67% of foreign-born doctorates were working in the United States two years after graduation. While the two-year "stay rate" for foreign-born PhDs rose in the 1990s, it fell over the 2000s.

In our research, we examine the post-degree location choices of foreign-born students receiving PhDs from US universities. Data are from the NSF Survey of Earned Doctorates (SED), which contains information on the characteristics of all individuals receiving a PhD from a US university over the period 1958 to 2008. The SED asks individuals if they plan to stay in the United States after completing their degree. Over the sample period, 77% of foreign-born S&E PhDs state that they plan to stay in the US, signalling intent, and 43% plan to stay *and* have made a commitment or signed a contract with an employer, signalling intent plus success in finding a job. We consider both outcomes, as well as the selection of foreign-born PhDs into broad sectors of employment (academia, private sector, public sector).

Combining the SED with data on economic conditions in the birth country of foreign students, we examine how location choices relate to student ability and to economic conditions in the US and in the birth country. The foreign students more likely to stay in the United States are those with stronger US ties, measured in terms of having a permanent residence visa or

completed their BA degree at a US college or university, and stronger academic ability, measured in terms of parental educational attainment, the student's success in obtaining graduate fellowships or scholarships, and the rank of the student's university and department. Foreign students staying in the United States therefore appear to be positively selected in terms of ability. These results are stronger for the joint outcome of intending to stay and having obtained a job, reinforcing the interpretation of positive selection.

We also find that foreign students are more likely to stay in the United States if in recent years the US economy has had strong GDP growth, their birth country has had weak GDP growth, or their birth country has had recent natural disasters. Foreign students are less likely to remain in the US if they are from countries with higher average GDP levels. For a developing country, its students studying abroad are less likely to stay in the US, the more developed the country becomes. Our findings suggest that there is potential for a virtuous cycle in education and innovation, with returning S&E PhDs increasing innovation in the home country, thereby enhancing prospects for economic growth and raising the attractiveness of the home country as a location for future PhD recipients.

Our work helps push the analysis of international migration in developing countries to realm of very highly skilled labor. Previous research suggests that emigrants from poor countries are positively selected in terms of schooling and that more-educated migrants favor destination countries that reward skill more heavily. Our work shows that there is positive selection in migrant location choices even among the most highly educated individuals and that selectivity is pro-cyclical. We know that top scientists are relatively likely to launch high-technology companies. The countries that attract more able PhD recipients may therefore enjoy a larger boost to innovation.

Other recent research examines the impact of high-skilled immigration on economic outcomes in sending and receiving countries. Greater opportunities for high-skilled emigration in low-income countries may increase incentives for educational attainment sufficiently to offset the human capital lost to labor outflows. Further, flows of students to the US for PhD training may improve the quality of higher education in sending countries, further enhancing local human-capital accumulation. Our work indicates that the increase in incentives for educational attainment in low-income countries may be strongest among the most able, which enhances the quality of local human capital, but also that the highly talented who do succeed in going abroad for advanced training are the least likely to return home, at least immediately following their education. In the United States, regions that attract more high-skilled immigrants produce larger numbers of S&E patents. The tendency of the most able PhDs to remain in the United States may in part explain the positive impact of high-skilled immigration on patenting, given the proclivity on these individuals for innovation. These location patterns also imply that poor countries sending students to the US for advanced S&E training may see those with the greatest innovative potential choose not to return home.