# Immigration Pathways and Plans of AI Talent

## Findings from a CSET Survey of Artificial Intelligence PhDs from U.S. Universities

CSET Data Brief

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## Executive Summary

Much debate surrounds immigration policy and the AI workforce in the United States.[1] A better understanding of the immigration trajectories and plans of AI talent can inform policies that effectively recruit and retain top AI talent. To explore the immigration paths of AI talent, we surveyed recent graduates from top-ranking AI PhD programs in the United States about their location preferences, career motivations, and immigration plans.[2] We asked both U.S. citizens and non-citizens about their decisions to pursue a PhD in the United States and whether to remain in the country after graduation, as well as their future prospects of moving to another country. We inquired with non-citizens in particular about their immigration status and plans. We received responses from 254 AI PhDs, a representative sample in terms of gender, nationality, and current country of employment.[3]

Results indicate that:

- **AI talent finds the United States an appealing place to study and work.** AI talent is drawn to the United States for the high quality of education, and PhDs were motivated to stay for the location and professional opportunities. Nearly all surveyed AI PhDs currently work in the United States or plan to return at some point in their career.
- **AI PhDs working in the United States plan to stay.** Both U.S.-citizen and non-citizen respondents working in the United States report low likelihoods of moving to another country. Among those who are not currently U.S. citizens, 74 percent plan to apply for permanent residency or citizenship when eligible.
- **A majority of AI PhDs who left the United States were motivated by family obligations and/or professional opportunities abroad.** Job opportunities abroad were extremely relevant to 60 percent and family obligations abroad were extremely relevant to 57 percent of AI PhDs who left the United States. In their own words, about half cite family-related reasons as a primary driver in their decision to leave while more than a third say specific research or job opportunities motivated them to leave the United States.
- **About a third of AI PhDs who left the United States considered immigration highly relevant to their decision to leave.** When providing reasons for leaving in their own words, 23 percent identified immigration-related concerns, while 33 percent selected the

U.S. immigration system as an extremely relevant factor in the decision to leave.

- **A majority of non-citizen AI PhDs working in the United States experienced significant difficulties with the U.S. immigration system.** 60 percent of AI PhDs working in the United States who are not U.S. citizens report difficulties with the U.S. immigration system, compared to 12 percent of AI PhDs who are non-citizens working in other countries. Of non-citizen AI PhDs in the United States who reported difficulties, 44 percent said those difficulties stemmed from visa issues for their spouse or family member and 77 percent said their immigration difficulties made them more likely to leave the United States.

- **AI PhDs who left the United States remain highly mobile.** AI PhD respondents working outside the United States report high probabilities of moving to another country. Non-citizen AI PhDs working outside the United States are more likely to be temporary residents without plans to apply for permanent residency or citizenship, compared to non-citizens working in the United States.

## Immigration Decisions

While all respondents completed their PhDs in the United States within the last 10 years, they were born in 43 different countries, completed their undergraduate degrees in 37 countries, and currently work in 22 countries.[4]
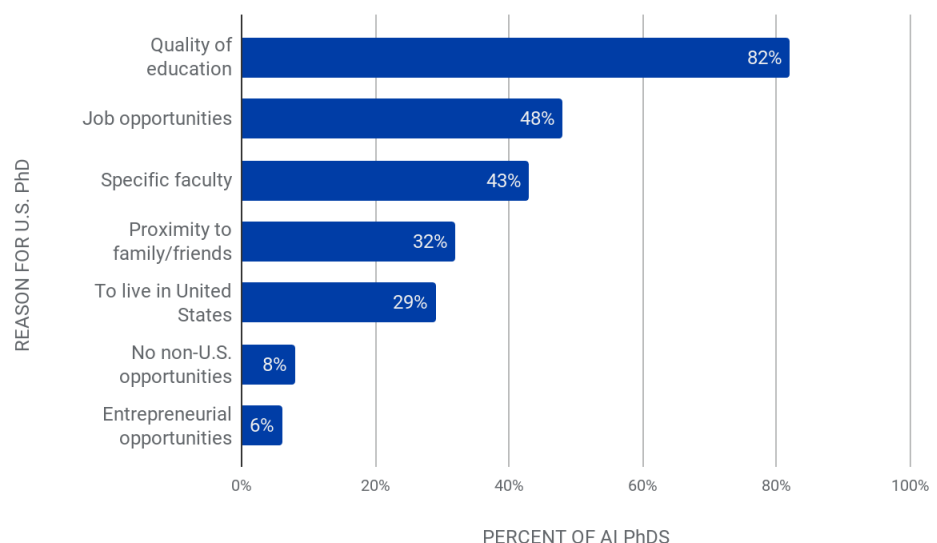
Specific to the United States:
- 58 percent of respondents are U.S. citizens
- 62 percent completed their undergraduate education in the United States
- 83 percent currently work in the United States

After the United States, the most common countries of birth and undergraduate education were China, India, and South Korea. The most prevalent current work locations outside the United States are the UK, Singapore, Germany, and France.

*Reasons for Completing PhD in the United States*

First, we asked respondents their reasons for completing a PhD in the United States. Responses are displayed in Figure 1. A large majority of respondents identified the high quality of education as a top reason. Future job opportunities and the chance to work with specific faculty were also common.

Figure 1. Reasons for Completing PhD in the United States



Respondents' selections in response to "Why did you choose to complete your doctorate in the United States?" Respondents could select up to three reasons. Seven percent selected "other" and entered program-specific reasons (e.g. course offerings) or financial reasons (e.g. cost). Respondents: 254. Source: CSET 2019 AI PhD Survey.

Upon enrolling in a U.S. PhD program, most respondents planned to stay in the United States. 93 percent planned to pursue post-PhD careers in the United States, specifically in U.S. academia (32 percent), the U.S. private sector (12 percent), or both (48 percent).[5] We also asked respondents what they would have done if they had not enrolled in a U.S. PhD program. Seventy-three percent said they would have entered the workforce and 35 percent would have considered a PhD program outside the United States.[6] Fifty-two percent of respondents would have pursued alternate plans in the United States. Other countries where talent considered studying or working included the UK (21 percent), Germany (12 percent), Canada (12 percent), Switzerland (eight percent), France, (five percent), and China (five percent).

Of respondents who considered alternate plans in the United States, 79 percent were U.S. citizens. Removing cases of respondents selecting their home country, the UK was the most frequently considered alternative to a U.S. PhD program.[7] Eight to 11 percent of respondents considered Canada, Germany, and Switzerland as non-home country alternatives to a U.S. PhD program. All respondents who reported alternate plans in China were born in China.[8]

*Reasons for staying in the United States after degree*

After completing their PhD, 83 percent of respondents stayed to work in the United States.[9] For a majority, location was a critical factor in deciding where to work after PhD completion.[10] The ability to pursue personal research interests and work on interesting technical challenges were also frequent considerations among PhDs who stayed in the United States, as shown in Figure 2.

## Figure 2. Top Post-PhD Job Considerations
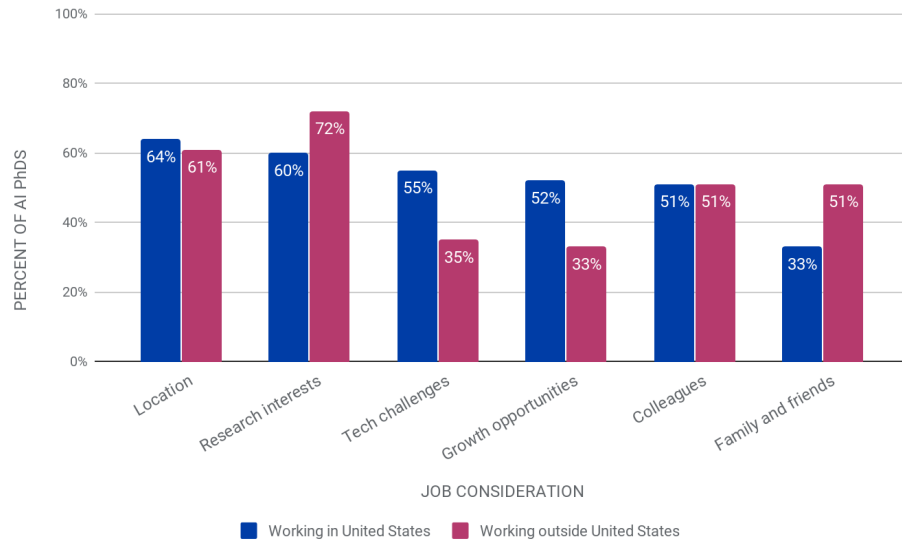


Respondents' top considerations for job choice after PhD completion. Question asked, "When deciding where to work after completing your PhD, what were the most important considerations?" Respondents could select up to five considerations. The differences in proportions for tech challenges, growth opportunities, and family and friends are statistically significant at the 95 percent confidence level (p=.02). Four additional considerations—salary, ability to have positive impact, access to unique resources, and immigration concerns—were included in the survey, but are not displayed because they were not a top five selected consideration by either group or had no significant difference between the groups. Respondents: 211 working in the United States and 43 working outside the United States. Source: CSET 2019 AI PhD Survey.

### Reasons for leaving the United States after degree

Figure 2 shows that PhDs who left the United States after graduation had different priorities than PhDs who stayed. While location and research interests remain a frequent consideration, more PhDs who left the United States selected family and friends as a top consideration and fewer selected growth opportunities or the ability to work on interesting technical challenges, compared to PhDs who stayed.[11]

There was also a notable difference in the role of immigration concerns in post-PhD job decisions for PhDs who stayed or left the United States. As shown in Figure 3, more PhDs who left the United States selected immigration concerns as a top consideration compared to PhDs who stayed in the United States. Yet immigration concerns were a more frequent consideration in the post-PhD job decision for PhDs who stayed to work in the United States but are not U.S. citizens.[12]

Figure 3. Immigration Concerns as Top Post-PhD Job Consideration
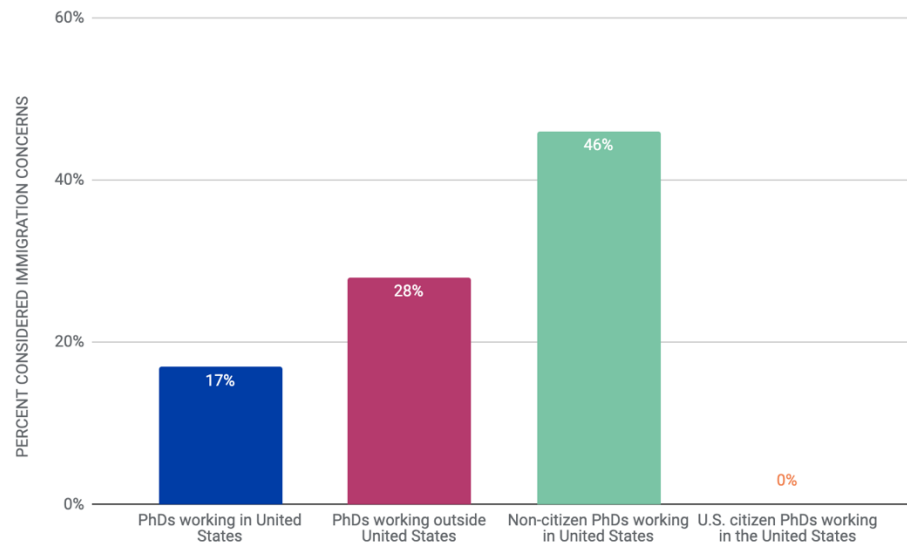


Percentage of respondents who selected immigration concerns in response to, "When deciding where to work after completing your PhD, what were the most important considerations?" Respondents could select up to five considerations. The difference in proportions for PhDs working in the United States versus outside the United States is statistically significant at the 90 percent confidence level (p=.08). The difference in proportions for non-citizen PhDs working in the United States versus U.S. citizen PhDs working in the United States is statistically significant at the 95 percent confidence level (p=.00). Respondents: 211 working in the United States, 43 working outside, 76 non-citizen PhDs working in the United States, and 135 U.S citizen PhDs working in the United States. Source: CSET 2019 AI PhD Survey.

To further understand the motivations of PhDs who left the United States, we asked them to share their main reasons for leaving in their own words.[*] Family-related reasons were most common. Half of respondents left to be closer to family, for a partner's career, or for other familial obligations. Professional considerations were also common. Thirty-five percent cited appealing research opportunities outside the United States, such as working at a specific lab or on interesting research, and 15 percent specified limited or unappealing opportunities in the United States. Twenty-three percent noted immigration-related reasons, such as sponsor or visa expiration, spousal restrictions, or general uncertainty around the U.S. immigration system.

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[*]This was an open-ended question that asked, "What were the main reasons for your decision to leave the United States after obtaining your PhD?" Respondents could list several reasons. For example, a respondent who left to be closer to family and work at a specific university. This question was asked before respondents answered the close-ended question reported in Figure 4.

We also asked respondents working outside the United States how relevant specific factors were in their decision to leave. Responses are displayed in Figure 4. Again, family considerations and job opportunities were highly relevant.

Figure 4. Reasons for Leaving the United States
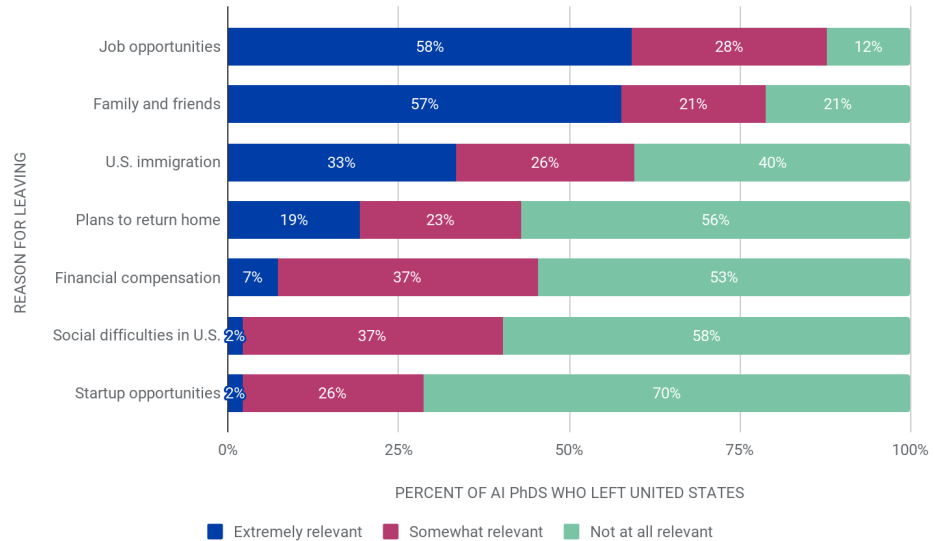


Respondents' ranking of specific reasons as "extremely," "somewhat," or "not at all" relevant in their decision to leave the United States. The question asked, "When you decided to leave the United States after obtaining your PhD, how relevant were the following considerations?" Percentages do not sum to 100 percent due to rounding. Respondents: 43. Source: CSET 2019 AI PhD Survey.

Immigration was also a relevant consideration for 59 percent of PhDs who left the United States. We asked those who reported immigration as relevant whether they experienced visa or status issues for themselves, their spouse or family member, or both themselves and a family member. Sixty-eight percent specified visa or status issues for themselves, 44 percent reported issues for their spouse and/or family member, and 28 percent reported issues for both themselves and their family member(s). Twenty percent said their immigration-related concerns were not specific visa or status issues.

## Immigration Pathways

In addition to the motivations behind staying or leaving the United States, we asked about AI PhDs' immigration trajectories. The majority of respondents are citizens in their country of employment; those that are not tend to be temporary residents. While more PhDs working outside the United States are non-citizens in their country of employment, they had fewer difficulties with the immigration system in that country.

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**Box 1. Key Immigration Terms and U.S. Programs**

**Temporary resident.** Temporary residents are individuals with the right to study or work in a country for some limited amount of time. In the United States, the most common temporary programs relevant to our respondents include:

**Optional Practical Training** (OPT), which allows international students (as part of their F-1 visa) to work for a U.S. employer for up to three years. Since our respondents are former PhD students, all are eligible for OPT.

The **H-1B** visa is available to workers in high-skilled positions ("specialty occupations"). Some eligible workers are unable to get the visa because there are typically more applicants than available slots.[13]

The **O-1** visa is available to workers with "extraordinary ability," judged on criteria such as patents, publications, and major awards.

The **J-1** visa is available to researchers and professors and is often used to sponsor post-doctoral researchers or other temporary research positions.

**Permanent resident**. Permanent residents are allowed to live and work in a country indefinitely even though they are not citizens. In the United States, those with permanent residency are often referred to as "green card" holders.

**Citizen**. Individuals can be citizens of a country either by birth or through naturalization. In the United States, immigrants can naturalize after holding permanent residency for several years. Most foreign-born respondents in our survey have not been in the United States long enough to have become citizens.

Other CSET reports provide more detailed overviews of the United States' and other countries' immigration systems as they relate to AI talent, including *Immigration Policy and the U.S. AI Sector* (September 2019), *Keeping Top AI Talent in the United States* (December 2019), and *Immigration Policy and the Global Competition for AI Talent* (June 2020).

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*Most common visa and immigration pathways*

As displayed in Figure 5, PhDs working outside the United States are more commonly non-citizens in their country of employment compared to PhDs working in the United States. Of AI PhDs working outside the United States, 56 percent are not citizens in their country of employment, including 40 percent who are temporary residents. The prevalence of temporary residents outside the United States may be due to the fact that respondents recently attended a U.S. university, making them more likely to be early in their residency period in their employment country.

Figure 5. Immigration Status of AI PhDs in Country of Employment
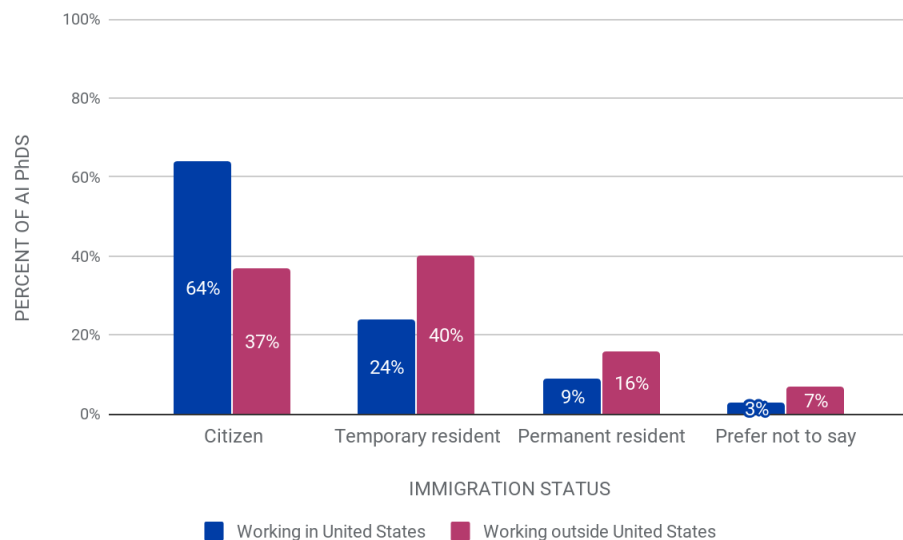


Percentage of respondents with each immigration status in their country of employment. Respondents: 211 work in the United States and 43 work outside the United States. Source: CSET 2019 AI PhD Survey.

Figure 6 breaks down current and past visa status for PhDs who are not U.S. citizens but work in the United States. Seventy-two percent are currently temporary residents on either OPT, H-1B, J-1, or O-1 visas and 28 percent are permanent residents. In terms of past status, a large majority were previously on OPT, including 89 percent of current permanent residents. Accounting for respondents who are both currently on OPT and who have held that status in the past, 84 percent of non-citizen AI PhD respondents working in the United States have been on OPT at some point.[14]

Figure 6. Immigration Status of Non-Citizen AI PhDs in the United States
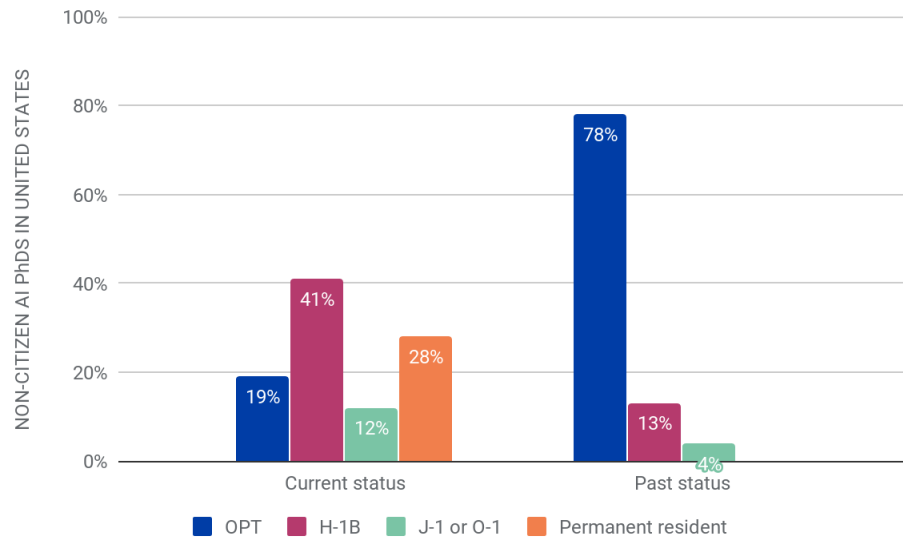


Current and past immigration status of non-citizen respondents working in the United States who reported their current and past status. Respondents: 69. Source: CSET 2019 AI PhD Survey.

*Immigration difficulties*

We asked respondents who are not citizens in their country of employment if they encountered significant difficulties with its immigration system; 47 percent said yes. As displayed in Figure 7, 60 percent of PhDs working in the United States who are not U.S. citizens report significant difficulties with the U.S. immigration system. Seventy-eight percent who reported difficulties said such difficulties made them more likely to leave the United States. In comparison, PhDs working in other countries where they are not citizens rarely report significant difficulties with their country of employment's immigration system.

Figure 7. Immigration Issues Among Non-Citizens in Employment Country
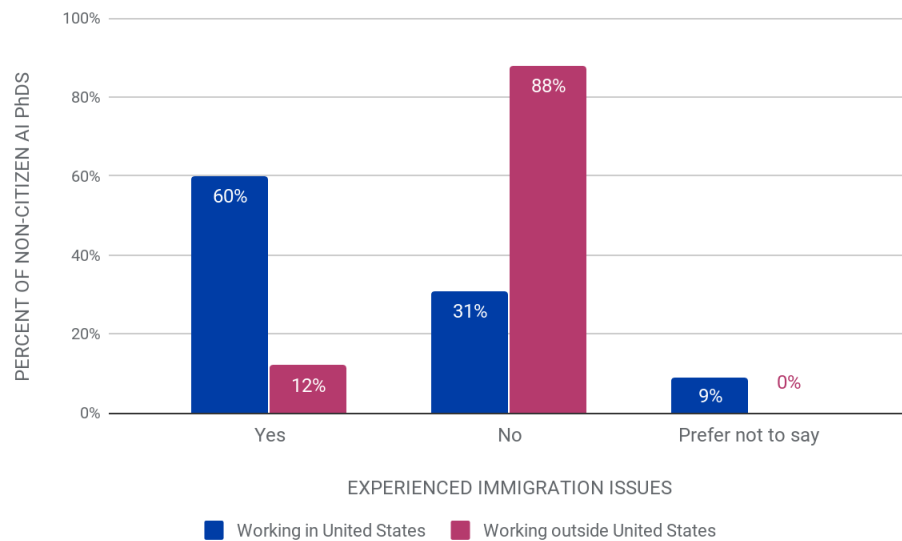


Percentage of respondents without citizenship status in their country of employment who reported difficulties with immigration system. Question asked, "Have you encountered significant difficulties with the immigration system in [country of employment]?" Respondents: 69 work in the United States. and 24 work outside of the United States. Source: CSET 2019 AI PhD Survey.

When asked to elaborate on the immigration difficulties faced in the United States, respondents noted barriers including high costs, a lack of information, limited navigability, hostile personnel, excessive requirements, long wait times, and restrictive stay limits. A few noted the psychological stress that accompanied these difficulties.[†]

We also asked non-U.S. citizen respondents what, if any, challenges they faced during their time studying and/or working in the United States. As shown in Figure 8, no single challenge stands out or was faced by a majority of non-citizens during their time in the United States. Financial strain was most common, which is unsurprising given the financial pressures faced by graduate students.

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[†] This was an open-ended question that asked, "Feel free to elaborate on any difficulties you've experienced with the immigration system in [country of employment]." Question was only asked to respondents who indicated they experienced difficulties with the immigration system in their country of employment.

Figure 8. Challenges Faced by Non-Citizens While in the United States
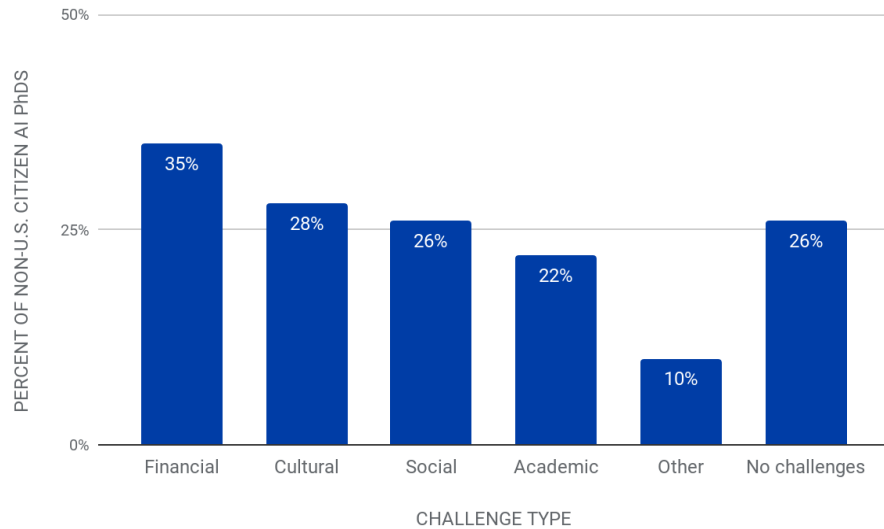


Reported challenges experienced by respondents who are not U.S. citizens during their time in the United States. Question asked, "Did you encounter any of the following challenges while studying and, if applicable, working in the United States?" Respondents could select all that applied. Entries for other challenges included immigration, health, racism, and temporary challenges that were resolved. Respondents: 109.  Source: CSET 2019 AI PhD Survey.

## Future immigration plans

Finally, we asked AI PhDs their likelihood of moving to another country and, if applicable, their plans to apply for permanent residence in their current country of employment. Most AI PhDs do not plan to move to another country in the immediate future, but are open to moving abroad at some point in their career. PhDs working in the United States report a lower likelihood of moving to another country at any time compared to PhDs working outside the United States. Specific to non-citizens in their country of employment, those working in the United States are more likely to apply for permanent residence and/or citizenship status, while those working in other countries are more likely to be undecided or not planning to apply to stay in their country of employment.

*Moving abroad*

We asked respondents their likelihood of moving to another country in the next three years and at any time during their career. Many report a less than 50 percent likelihood of moving to another country in either time frame. Yet a higher proportion of respondents indicate some likelihood of moving to another country in the long term. On average, respondents indicated a 24 percent likelihood of moving to another country in the next three years and a 44 percent chance of moving at some point in their career.

Figure 9 compares the reported likelihoods of moving to another country in the short and long terms for AI PhDs working in the United States to those outside the United States. Overall, the reported likelihood of moving to another country was higher among respondents working outside the United States. AI PhDs working in the United States report a 20 percent or lower likelihood of moving to another country in the next three years. This group reports a higher likelihood of moving to another country at some point, but most still report a 50 percent or lower likelihood of leaving the United States, with an average 40 percent likelihood of moving at some point.

Figure 9. Likelihood of Moving to Another Country



LIKELIHOOD OF MOVING TO ANOTHER COUNTRY

■ Next 3 years    ■ During career
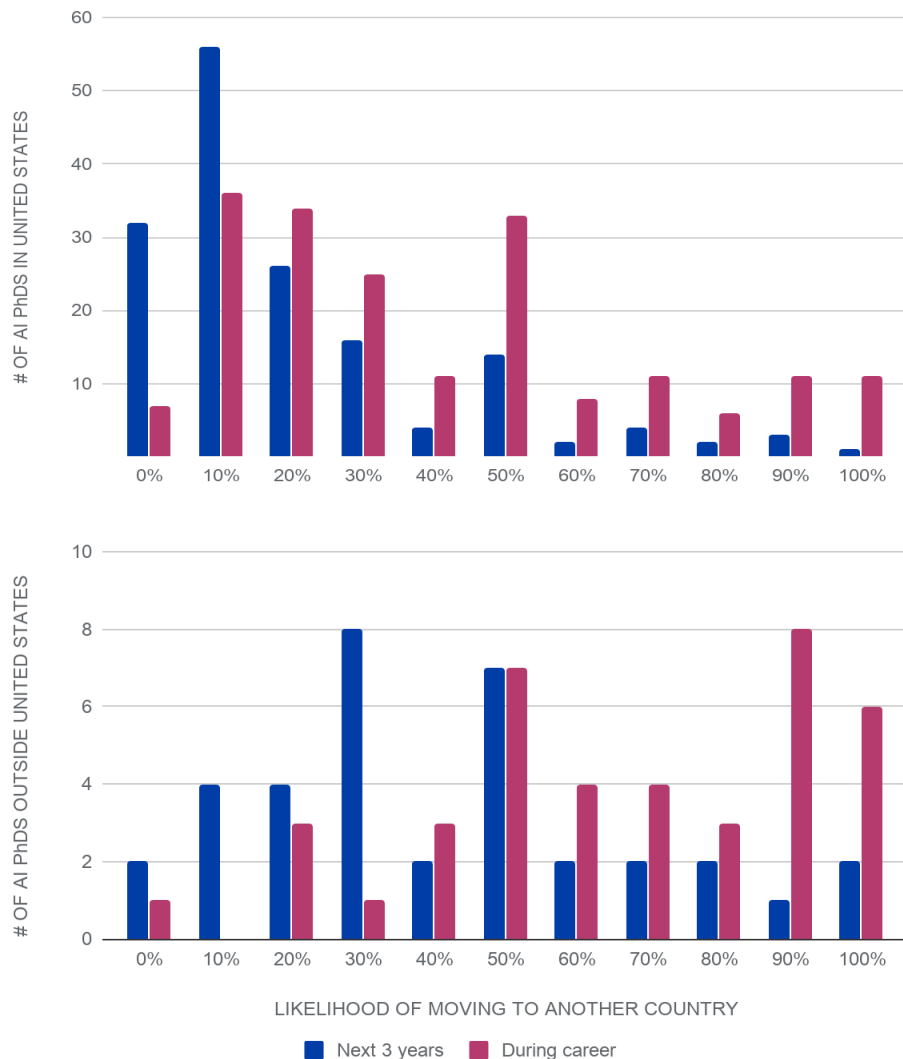
Number of respondents reporting zero to 100 percent likelihood of moving a) from the United States to another country in the next three years (160 respondents) or at any point during their career (193 respondents) and b) from their non-U.S. country of employment to another country in the next three years (36 respondents) or at any point during their career (40 respondents). Source: CSET 2019 AI PhD Survey.
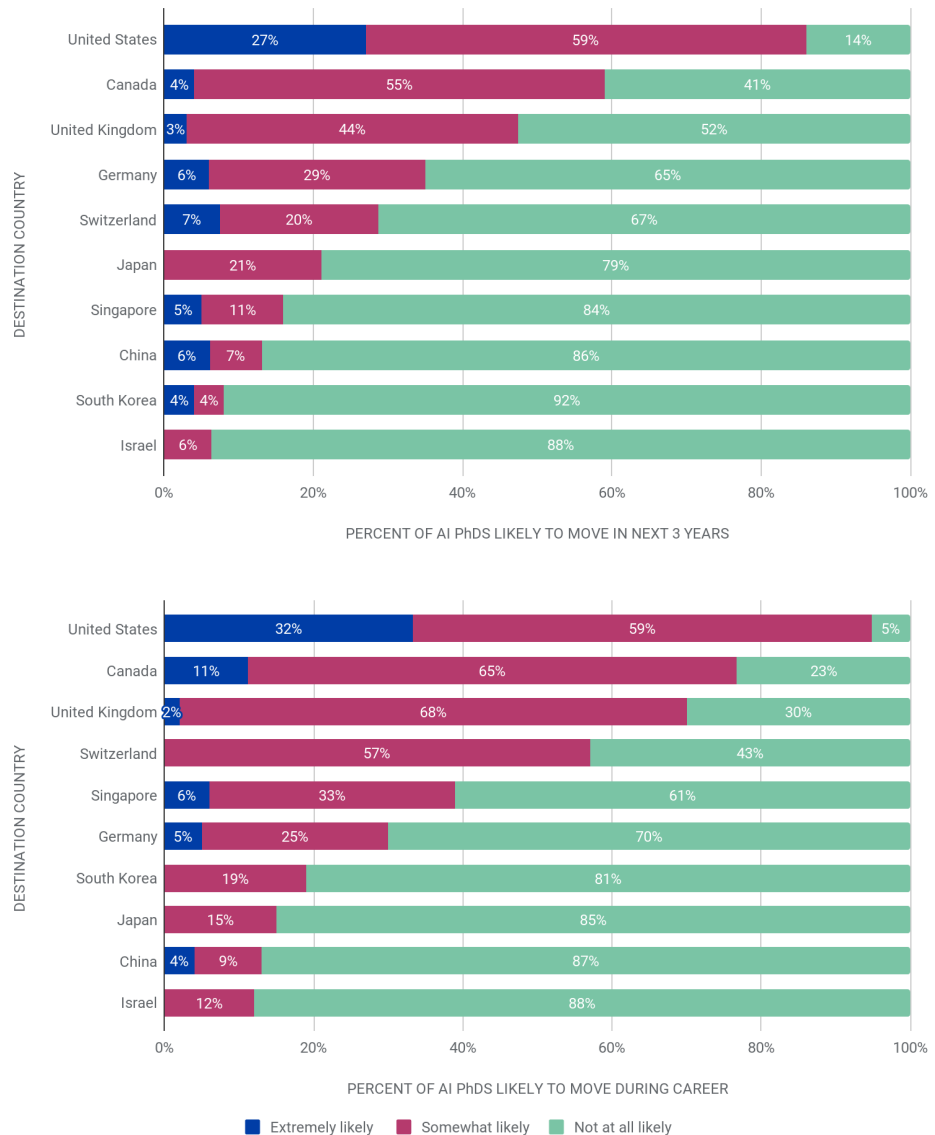
Among respondents working outside the United States, a majority report a 50 percent or lower likelihood of moving to another country in the next three years, for an average 42 percent likelihood. Yet a majority report a 50 percent or greater likelihood of moving to another country at some point in their career, for an average 66 percent likelihood.

*Moving to specific countries*

We also asked respondents the likelihood they would move to specific countries in the next three years or at any point in the future.[15] Responses are displayed in Figure 10. Each respondent was asked the likelihood they would move to the United States, China, Canada, and the United Kingdom, plus one randomly selected country.[16] Respondents were not asked the likelihood of moving to the country where they were currently employed. Again, we find that AI PhDs generally report higher likelihoods of moving in the long term as opposed to in the next three years. In terms of destination countries, PhDs most often consider moving to the United States, Canada, or the UK, if they don't already work in those countries.

Almost all, 95 percent, of PhDs not currently in the United States report being somewhat or extremely likely to move to the United States at some point in their career.[17] Seventy-six percent indicate some likelihood of moving to Canada and 71 percent of moving to the UK during their career. Switzerland also stood out as a country respondents might move to at some point, with 57 percent reporting they are at least somewhat likely to move there during their career.

Figure 10. Likelihood of Moving to Specific Countries



PERCENT OF AI PhDS LIKELY TO MOVE IN NEXT 3 YEARS

PERCENT OF AI PhDS LIKELY TO MOVE DURING CAREER

■ Extremely likely   ■ Somewhat likely   ■ Not at all likely

Respondent likelihood of moving to another country in the next three years and at any point in respondent career as "extremely," "somewhat," or "not at all" likely. Destination countries are those where the respondent is not currently employed. Question asked, "How likely is it that you would move to the following countries in the next three years/at some point in your career?" United States (44 respondents), Canada (250), United Kingdom (250), China (250), Switzerland (35), Germany (37), Singapore (37), South Korea (47), Japan (54), and Israel (42). Source: CSET 2019 AI PhD Survey.

Other countries were less likely destinations for PhDs in the near or long term. Thirty-nine percent report some likelihood of moving to Singapore, while 35 percent report they are somewhat likely to move to Germany in the short term. Twenty percent or fewer report any likelihood of moving to Japan, South Korea, or Israel in the near or long term.

China does not appear to be a likely destination among AI PhDs. Eighty-six percent of respondents are not at all likely to move to China at any point. Of the few respondents who report some likelihood of moving to China, 47 percent are Chinese nationals working in the United States.[18] Combined with our finding that only Chinese-born respondents considered PhD-alternate plans in China, this suggests a very small subset—roughly seven percent—of AI PhDs who studied in the United States and were not born in China consider it likely they will move to China.

*Immigration status plans*

For respondents without citizenship status in their country of employment, we asked their immigration status plans. Most have set plans, whether to apply for permanent residence or not, but a sizable portion remain undecided. Among temporary residents, in any country, 64 percent plan to apply for permanent residency or/and citizenship, while 40 percent of permanent residents plan to apply for citizenship when eligible.

Figure 11 displays the immigration status plans of non-citizen respondents working in the United States. Seventy-four percent of temporary residents and 44 percent of permanent residents plan to apply for resident status. A small minority do not plan to apply for permanent residence.

Figure 11. Immigration Status Plans in the United States



Temporary residents    Permanent residents
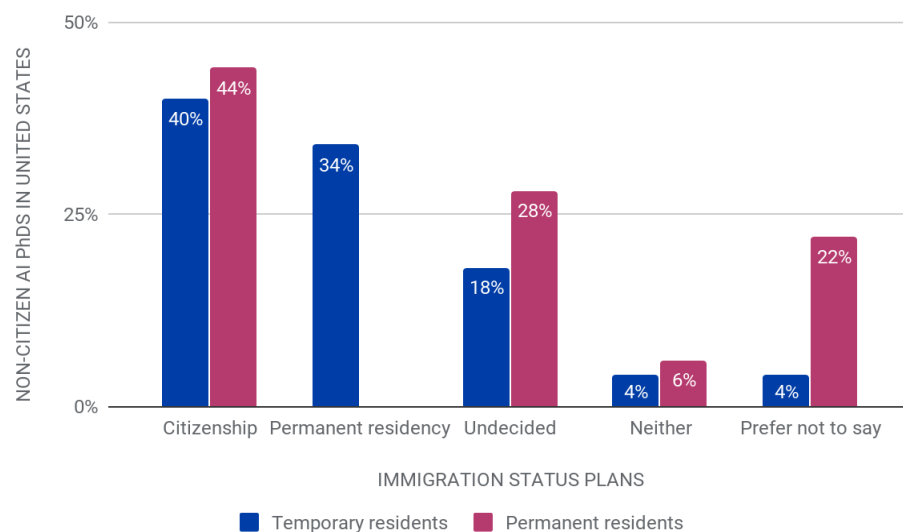
Immigration status plans of PhDs working in the United States who are not U.S. citizens. Question asked, "Do you plan to apply for permanent residency and/or citizenship in [country of employment], when you become eligible?" Temporary residents could choose permanent residency and citizenship, permanent residency, undecided, neither, or prefer not to say. Permanent residents could choose citizenship, undecided, neither, or prefer not to say. Respondents: 50 temporary residents and 19 permanent residents. Source: CSET 2019 AI PhD Survey.

Among non-citizen respondents working outside the United States, a much smaller proportion plans to apply for resident status while a larger proportion is undecided or plans not to apply for resident status. Given the small number of respondents on permanent status outside the United States, those results are not pictured, but show a similar pattern; most plan not to apply for citizenship or are undecided.[19]

## Conclusion

Our findings suggest that AI PhD talent wants to work in the United States. Quality education and appealing professional opportunities are unique U.S. assets for attracting and retaining AI PhDs. A large majority of non-U.S. citizen respondents want to stay in the United States and intend to apply for permanent residency or citizenship when eligible. Family obligations, professional opportunities, and immigration concerns motivated those who left to work elsewhere, although many say they are likely to return to the United States at some point in their career.

The appeal of the United States among AI PhDs is a strategic advantage for the U.S. AI workforce. As policymakers seek to maintain and strengthen this advantage, immigration policy presents an important opportunity. Stay rates among non-U.S. citizen AI PhDs are high, but could be higher.[20] Among those who leave, about a quarter said immigration-related issues were a primary reason for leaving the United States and a majority said the U.S. immigration system was at least somewhat relevant to their decision to leave. Meanwhile, some non-citizen AI PhDs working in the United States remain undecided about whether to apply for permanent residence. These findings suggest some AI talent trained in the United States leaves, or may leave, that might otherwise stay in the case of immigration reform. Several CSET papers offer recommendations for immigration reforms that would bolster the U.S. AI sector.[21]

Our results also suggest that a portion of U.S.-trained AI PhD talent will leave regardless of immigration reform. Some are motivated exclusively by family considerations or professional opportunities abroad and did not consider immigration relevant when deciding to leave the United States. This segment of AI PhDs is unlikely to be swayed by U.S. immigration reform. Additionally, attracting and retaining international talent is only one aspect of effective U.S. AI workforce policy. Measures to improve the U.S. immigration system should thus be paired with strong domestic investments in AI education and training.[22]

## Acknowledgments

## Appendix

*Survey Methodology*

For survey recruitment we identified nearly 3,500 PhDs based on their authorship of an AI- or ML-relevant dissertation between 2014–2018.[23] Using public online profiles, we manually identified emails for 2,325 PhDs. The survey was distributed online over three waves from November 2019 to January 2020 and completed by 254 U.S. AI PhDs, an 11 percent response rate.

The survey included 40-45 open and close-ended questions, depending on respondents' employment location and immigration status, and took an average of 18 minutes to complete. The survey asked for respondents' past education, current professional activities, career preferences, immigration and location preferences, and assessments of the AI workforce. We are happy to share the full survey questionnaire upon request. Key findings related to professional activities and career preferences are reported in a separate CSET paper.[24]

A pilot version of the survey was sent to a random sample of 150 PhDs from our full dataset of U.S. AI PhDs in November 2019. The pilot returned a seven percent response rate and led to the removal of two follow-up questions from the survey. Primary survey distribution occurred in December 2019 and elicited an 11 percent response rate. We conducted a final follow up distribution in January 2020 to 109 PhDs who did not receive the survey in previous distributions due to invalid emails. We manually identified alternate emails for those individuals and sent them the survey. The follow up distribution had a 14 percent response rate. Responses from the pilot and follow up distributions are included in the analysis. We also collected 39 partial responses, which are not reported here. Including the partial responses in our analysis did not alter our results.

*Sample representativeness*

Assessing the representativeness of our sample is difficult due to a lack of authoritative empirics on the demographic breakdown of AI talent and ambiguity about who should be considered part of the AI workforce. While our sampling frame allowed for the possible inclusion of individuals who wrote AI-related dissertations but do not work in AI-related fields, 84 percent of respondents report their current professional field as machine learning and 72 percent report applied research as a primary professional activity. This suggests our sample is representative of the AI workforce in terms of professional fields and activities.[25]

In terms of gender, respondents were predominantly male (74 percent), a proportion considered representative of the field.[26] In terms of nationality, 58 percent of respondents are U.S. citizens. The next most common countries of birth were China (eight percent) and India (seven percent). This is in line with recent CSET research using the National Science Foundation's Survey of Earned Doctorates that finds 55 percent of STEM U.S. PhDs are U.S. citizens, while Chinese and Indian nationals make up 16 percent and six percent respectively.[27] The difference in proportion of Chinese nationals (eight percent in our sample of U.S. AI PhDs compared to 16 percent of U.S. STEM PhDs) suggests they are somewhat underrepresented in our sample. This may be due to a high rate of invalid or unidentifiable emails for AI PhDs currently working in China (17 percent of unidentified emails compared to one percent of identified emails) and who completed their undergraduate education in China (25 percent of unidentified emails compared to 20 percent of identified emails). As an additional test of representativeness, we compared our sample to CSET's full dataset of U.S. AI PhDs from top-ranked programs. In terms of country of undergraduate education, country of current employment, and year of PhD completion, the survey sample appears representative of the target population.

One area where our sample may be unrepresentative is respondents' current sector of employment, with AI talent working in academia overrepresented in the sample. 54 percent of respondents work in academia, compared to 38 percent in the private sector. Recent CSET research analyzing the career paths of U.S. AI PhD graduates from top-ranked programs between 2014–2018 based on CV coding found 34 percent work in academia and 60 percent work in the private sector.[28] The prevalence of academics in this sample may be the result of a greater willingness among academics to complete the survey, but is also likely the product of the relative ease of access via email to talent working in academia as opposed to the private sector (e.g., higher rate of valid, identifiable emails, fewer email blockers or

restrictions around study participation). While our sample appropriately reflects the predominance of academia and industry in attracting AI talent, the potential overrepresentation of academia may skew our results toward the preferences of a subset of AI talent.

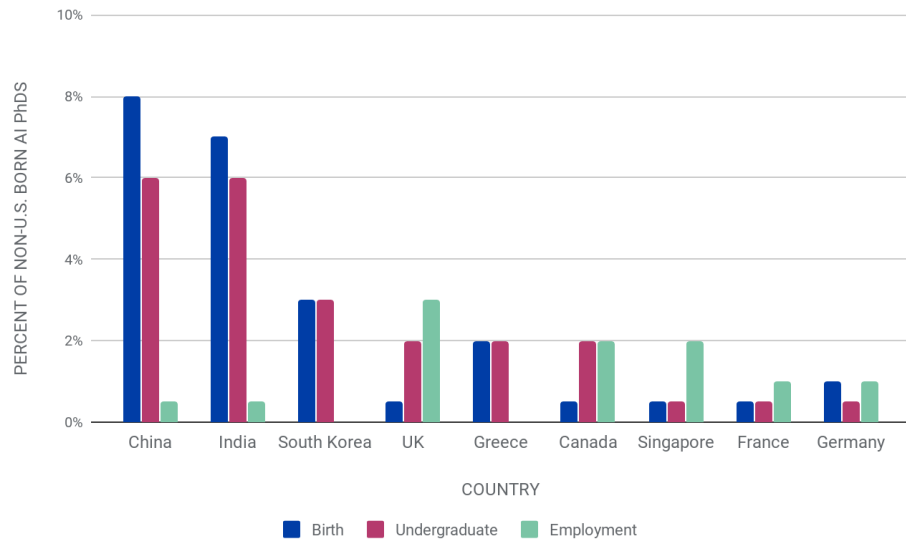*Country of origin, undergraduate education, and employment*

We asked respondents to provide their country of birth, country of undergraduate education, country where currently employed, and immigration status in country where currently employed. Our goal with asking these questions was to infer respondent nationality. We also asked respondents if their country of birth was different from their country of citizenship, and if so, to provide their country of citizenship. Eight percent of respondents are citizens in a country they were not born in. We also asked these questions to see if the country of undergraduate education, a common proxy for nationality, consistently matches country of birth.

We found some interesting differences in country of birth, undergraduate education, and current employment. The number of respondents who were:

- Born outside the United States is 112.
- Completed their undergraduate education outside the United States is 97.
- Employed outside the United States is 43.

Figure A shows the percentage of respondents who report non-U.S. countries as their country of birth, undergraduate education, and employment. Overall, there is more variation in the country of birth and undergraduate education than in the country of employment. After the United States, the largest proportion of respondents were born in China, India, or South Korea, but few, if any, respondents currently work in these countries. Additionally, more respondents completed their undergraduate education and/or work in the United Kingdom and Canada than were born there. The generalizability of these findings is an open question, given the small number of observations and potential underrepresentation of PhDs working in these countries within the sample.

Figure A. Country of Birth, Undergraduate Education, and Current Employment for Non-U.S. Born Respondents



Percentage of respondents who reported each country for country of birth, undergraduate education, and/or current employment. The United States is not included for purposes of comparison. Other countries not included were reported by less than one percent of respondents. Source: CSET 2019 AI PhD Survey.

# Endnotes

[1] Zachary Arnold et al., "Immigration Policy and the U.S. AI Sector" (Center for Security and Emerging Technology, September 2019), https://cset.georgetown.edu/wp-content/uploads/CSET_Immigration_Policy_and_AI.pdf.

[2] We identified the top 20 AI programs at U.S. universities using U.S. News & World Report's "Best Artificial Intelligence Programs," see https://www.usnews.com/best-graduate-schools/top-science-schools/artificial-intelligence-rankings. For additional information on the survey methodology, see Appendix. We acknowledge that AI PhDs who studied in the United States represent only one subset of the AI talent pool. We focus on this population due to 1) our interest in understanding educational and career decisions and 2) scoping limitations.

[3] The survey was sent to 2,325 U.S. AI PhDs for an 11 percent response rate, calculated according to American Association for Public Opinion Research's minimum response rate (RR1): the number of completed surveys divided by the number of eligible units in the sample, including cases of unknown eligibility (AAPOR *Standard Definitions* 2016). Accounting for instances of known invalid emails, the response rate increases to 12 percent. Sample representativeness is based on comparisons with CSET data on U.S. AI PhDs and recent research on AI talent. For more discussion of sample representativeness, see Appendix.

[4] To collect respondent nationality, we asked respondents their country of birth, country of undergraduate education, country where currently employed, and immigration status in country where currently employed. See Appendix for additional discussion of these results.

[5] Respondents could select up to three intended career tracks. For additional discussion on the career paths of U.S. AI PhDs, see Catherine Aiken, James Dunham, and Remco Zwetsloot, "Career Preferences of AI Talent," (Center for Security and Emerging Technology, June 2020), https://cset.georgetown.edu/research/career-preferences-of-ai-talent/.

[6] Respondents could select up to two alternate plans.

[7] No respondents who reported alternate plans in the UK were born in the UK.

[8] Alternate plans in the United States were second most common among Chinese-born respondents.

[9] This finding is similar to previous CSET research that found in the five years after PhD completion, 82–92 percent of PhDs stay in the United States. See Remco Zwetsloot et al., "Keeping Top AI Talent in the United States" (Center for Security and Emerging Technology, December 2019), https://cset.georgetown.edu/wp-content/uploads/Keeping-Top-AI-Talent-in-the-United-States.pdf.

[10] In addition to being an important consideration in AI PhDs' past job choice, location is an important factor in making a future job attractive among respondents in the United States, 54 percent of whom consider location extremely important to the attractiveness of a future job. This is especially the case among U.S. citizens working in the United States, 64 percent of whom consider job location extremely important. In comparison, 33 percent of respondents working elsewhere consider location extremely important to the attractiveness of a future job.

This difference is statistically significant at a 95 percent confidence level. For more discussion on the factors that make jobs attractive to AI talent, see Catherine Aiken et al., "Career Preferences of AI Talent."

[11] PhDs who stayed in the United States selected salary and the ability to have a positive social impact as important more often than family and social consideration, suggesting professional considerations weighed more heavily in the decision for those who stayed in the United States. This is likely in part because they did not have to decide between proximity to family and friends, presumably located in the United States, and their careers.

[12] 64 percent of those who stayed in the United States are U.S. citizens.

[13] "Characteristics of H-1B Specialty Occupation Workers," Department of Homeland Security, March 5, 2020, https://www.uscis.gov/sites/default/files/reports-studies/Characteristics_of_Specialty_Occupation_Workers_H-1B_Fiscal_Year_2019.pdf.

[14] 13 respondents reported current OPT status and 54 reported past OPT status, but nine of those were respondents who reported both current and past OPT status, resulting in 58 respondents on OPT at some point during their residency in the United States. That is 84 percent of the 69 respondents who report that they are currently temporary or permanent residents working in the United States.

[15] Respondents were randomly assigned to be asked whether they would move to the listed countries in three years (125 respondents) or at any point in the future (124 respondents).

[16] One of the following countries was randomly displayed to respondents: Germany, Singapore, Israel, South Korea, Japan, or Switzerland.

[17] A recent survey of AI researchers also found the United States to be the most attractive destination to AI talent, with a majority not based in the United States considering moving there. The survey also found the UK and Canada to be attractive destinations while China was not. See Remco Zwetsloot et al., "The Immigration Preferences of Top AI Researchers: New Survey Evidence," (Center for Security and Emerging Technology, forthcoming).

[18] Respondents who report being somewhat or extremely likely to move to China (32 respondents) were also born in the United States (four respondents), India (three respondents), South Korea (two respondents), Canada, Greece, Iran, Italy, Japan, or Singapore (one respondent). Approaching this topic from another perspective, of the 21 respondents born in China, 71 percent report some likelihood of returning to China at some point.

[19] Only seven respondents reported permanent status in their non-U.S. country of employment. Respondents working outside the United States who are non-citizens in their country of employment represent a small proportion of the sample; 26 percent of all non-citizen respondents and only nine percent of all respondents.

[20] Remco Zwetsloot et al., "Keeping Top AI Talent in the United States."

[21] Arnold et al., "Immigration Policy and the U.S. AI Sector"; Tina Huang and Zachary Arnold, "Immigration Policy and the Global Competition for AI Talent," (Center for Security and Emerging Technology, June 2020), https://cset.georgetown.edu/research/immigration-policy-and-the-global-competition-for-ai-talent/.

[22] Remco Zwetsloot et al., "Strengthening the U.S. AI Workforce," (Center for Security and Emerging Technology, September 2019), https://cset.georgetown.edu/research/strengthening-the-u-s-ai-workforce/.

[23] We collected dissertations that contained any of 100 keywords likely to appear in research or applications of AI and machine learning. We performed a manual review of dissertation metadata to exclude false positives. Additional collection of dissertations written in 2019 or before 2014 resulted in identification of more than 6,000 U.S. AI PhDs. If valid emails were found before survey distribution began, they were included in the email count. In total, less than 20 percent of respondents were 2019 or pre-2014 graduates. For additional discussion, see Appendix in Remco Zwetsloot et al., "Keeping Top AI Talent in the United States." To define top-ranked AI universities we used U.S. News & World Report's 2018 ranking, which included the following universities: Carnegie Mellon University, Massachusetts Institute of Technology, Stanford University, University of California Berkeley, University of Washington, Cornell University, Georgia Institute of Technology, University of Illinois-Urbana Champaign, University of Texas-Austin, University of Michigan, University of Massachusetts-Amherst, Columbia University, University of Pennsylvania, University of California Los Angeles, University of Southern California, University of Maryland-College Park, Princeton University, Harvard University, California Institute of Technology, and University of Wisconsin-Madison.

[24] Catherine Aiken et al., "Career Preferences of AI Talent."

[25] For more information on the professional fields and activities of this sample, see Catherine Aiken et al., "Career Preferences of AI Talent."

[26] See Jean-Francois Gagne, Grace Kiser and Yoan Mantha, "Global AI Talent Report 2019," (Element AI, 2019), https://jfgagne.ai/talent-2019/; P. M. Krafft, Meg Young, Michael Katell, Karen Huang, and Ghislain Bugingo, "Defining AI in Policy versus Practice," (2020 AAAI/ACM Conference on AI, Ethics, and Society, February 2020), https://dl.acm.org/doi/10.1145/3375627.3375835; Sarah Myers West, Meredith Whittaker, and Kate Crawford. "Discriminating Systems: Gender, Race, and Power in AI," (AI Now Institute, April 2019), https://ainowinstitute.org/discriminatingsystems.pdf.

[27] While our sample matches the general trend in nationality of STEM U.S. PhDs, Chinese nationals are slightly underrepresented in the sample. Remco Zwetsloot et al., "Keeping Top AI Talent in the United States"' Remco Zwetsloot, Jacob Feldgoise, and James Dunham, "Trends in U.S. Intention-to-Stay Rates of International Ph.D. Graduates Across Nationality and STEM Fields," (Center for Security and Emerging Technology, April 2020), https://cset.georgetown.edu/wp-content/uploads/CSET-Trends-in-U.S.-Intention-to-Stay-Rates.pdf.

[28] Remco Zwetsloot et al., "Keeping Top AI Talent in the United States."