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# The Immigration Preferences of Top AI Researchers: New Survey Evidence

Remco Zwetsloot, Baobao Zhang, Markus Anderljung, Michael C. Horowitz, Allan Dafoe

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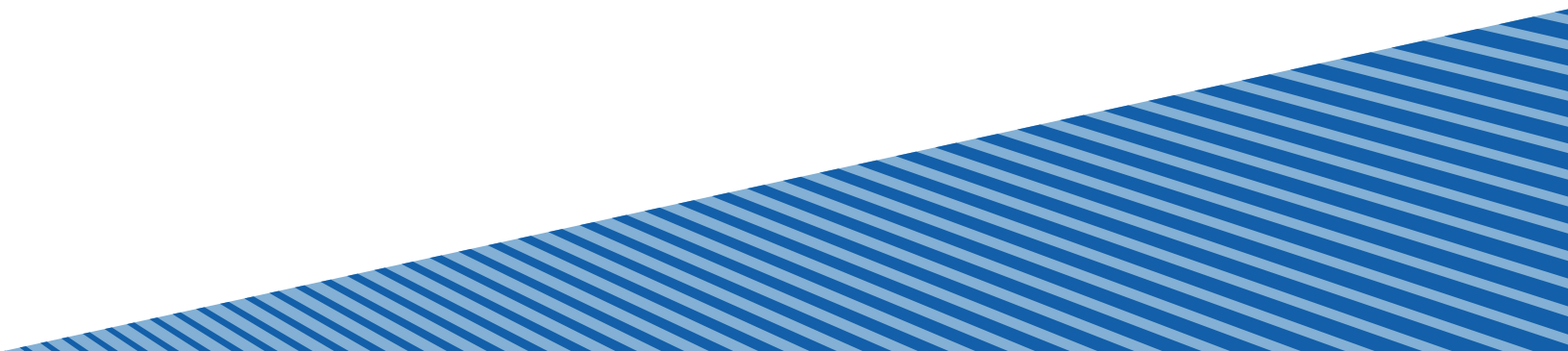
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# About the Authors



**Remco Zwetsloot**

@r\_zwetsloot

Remco Zwetsloot is a Research Fellow at Georgetown's Center for Security and Emerging Technology

**Baobao Zhang**

@baobaofzhang

Baobao Zhang is Klarman Postdoctoral Fellow in the Cornell Society of Fellows, Cornell University



**Markus Anderljung**

@manderljung

Markus Anderljung, Project Manager: Operations & Policy Engagement, Centre for the Governance of AI at the Future of Humanity Institute, Oxford University

**Michael C. Horowitz**

@mchorowitz

Michael C. Horowitz is Richard Perry Professor and Director of Perry World House at the University of Pennsylvania



**Allan Dafoe**

@allandafoe

Allan Dafoe is Associate Professor in the International Politics of Artificial Intelligence, and Director of the Centre for the Governance of AI at the Future of Humanity Institute, Oxford University

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## Executive Summary

Artificial intelligence (AI) talent is global. AI researchers and engineers come from, and are in high demand, all over the world. Countries and companies trying to recruit and retain AI talent thus face immense competition. In order to understand current and prospective flows of talent, we investigate the drivers of AI researchers' immigration decisions and preferences.

Immigration questions are particularly salient for the United States today, as half of its current AI workforce and two-thirds of graduate students in AI-related graduate programs were born elsewhere.<sup>1</sup> Some experts believe that the current U.S. immigration system will prevent or dissuade many of these international graduates from staying in the country, potentially undermining the vitality of the U.S. technology sector.<sup>2</sup> Many other countries have also seen recent immigration policy debates centered on attracting AI talent.<sup>3</sup>

To better understand the immigration decisions and preferences of this global AI workforce, we conducted a survey of more than 500 active researchers who publish in the

leading machine learning conferences.<sup>4</sup> Key findings include:

- **Some countries are considerably more attractive to AI researchers than others.**
  - Nearly 60 percent of respondents not currently based in the United States think there is a greater than one-in-four chance they will move there within the next three years. The same percentages are 35 percent for the United Kingdom, 28 percent for Canada, and 10 percent for China.
  - Some countries, such as the United States and the United Kingdom, are attractive to researchers from a diversity of backgrounds, while other countries, such as China and France, mostly appeal to researchers who grew up in that country or its vicinity.
- **Decisions about when and where to move depend on a mix of professional, personal, and political factors.**
  - When asked what factors affected respondents' moving decisions, more than 90 percent reported that a country's professional environment and opportunities were important to them. "Lifestyle and culture" (79 percent), the "political climate" (66 percent), and "personal relations" (60 percent) came next. "Immigration incentives in the destination country"

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and “immigration difficulties in the country of residence” were less important (47 percent and 24 percent, respectively).

- o All respondents considered “professional opportunities,” as well as “lifestyle and culture,” the most important factors, regardless of where they live. However, respondents who currently live in Asia were less likely than those in Europe or North America to rate “personal relations” or the “political climate” as a key factor.

- **AI researchers consider legal immigration barriers a bigger problem in some countries than in others.**

- o Nearly 70 percent of AI researchers based in the United States considered “visa and immigration issues” a serious problem for AI research in the country. This was significantly higher than in the United Kingdom (44 percent), Canada (29 percent), China (16 percent), and other countries.
- o As a whole, these findings suggest that the optimal strategies for countries to attract and retain AI talent will vary, depending on national strengths and weaknesses. For countries like the United States, and to a lesser extent the United Kingdom and Canada, the biggest obstacle to international talent

recruitment is not attractiveness but legal immigration barriers. For countries like China, however, the opposite is true: the main barriers to attracting AI talent are not legal but professional, cultural, and political in nature.

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## Data

This paper draws on data from a survey of AI experts who answered several immigration-related questions. The experts were selected based on having papers accepted at top AI research conferences. One group of respondents consisted of researchers who participated in the 2018 Conference on Neural Information Processing Systems (NeurIPS) and the 2019 International Conference on Machine Learning (ICML). Another group had papers accepted at NeurIPS and ICML in 2015 and participated in a 2016 expert survey on AI, fielded by several authors of this paper.<sup>5</sup>

Out of the 3,030 researchers contacted to complete the survey, 524 researchers (17 percent) completed the survey.<sup>6</sup> The survey respondents work and study in more than two dozen countries, although a majority are based in North America and Western Europe. Respondents were asked about a range of issues, including but not limited to immigration.<sup>7</sup> Appendix B discusses the sample in more detail, compares survey respondents with nonrespondents to assess representativeness, and lists the complete survey questions and answer options.

## Findings

This paper presents results on three questions:

1. How likely are AI researchers to migrate and where?
2. What factors affect researchers' moving decisions? and
3. Do researchers consider immigration policy a challenge to the AI sector in their country of residence?

### AI Researchers' Likelihood of Migrating

To gauge AI researchers' likelihood of migrating, and different potential destination countries' level of appeal, respondents were asked: "Of the following countries, which would you have a greater than 25% likelihood of moving to for work or study in the next three years?" Respondents saw a list of 10 countries that they could indicate an interest in, as well as an open textbox where they could list additional countries.<sup>8</sup> Their current country of residence was omitted from the answer list.

Figure 1 shows the percentage of respondents who said they might move to each of the listed countries. The United States





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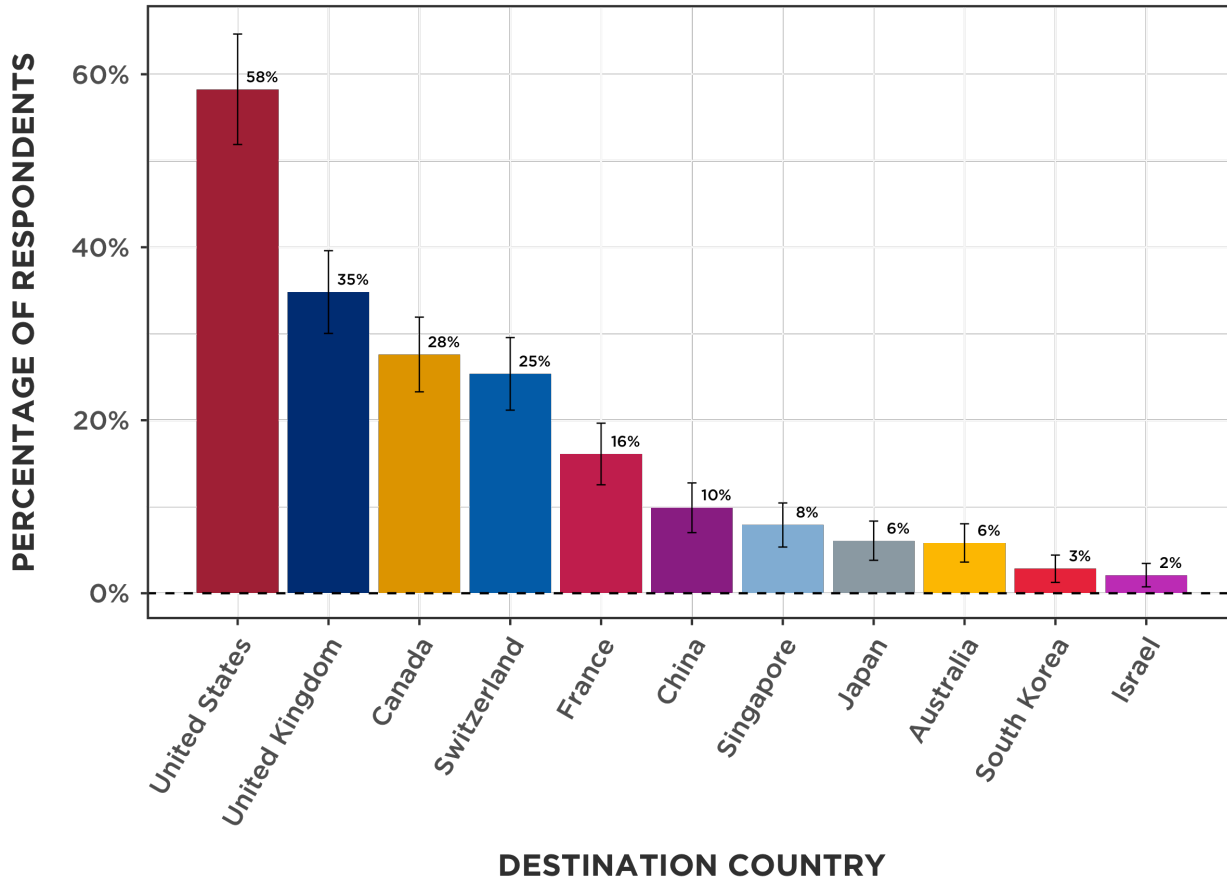


Figure 1 | Which countries are AI researchers most likely to move to? | This graph shows the percentage of AI researchers who reported a greater than 25 percent chance of moving to a country for work or study within the next three years. Respondents were presented with a list of countries to choose from (see Appendix B for a full list), which omitted their country of residence. There was also a “none of these” and an “other” option in which respondents could write a different country they had a greater than 25 percent chance of moving to. Error bars represent 95 percent confidence intervals.

scored highest, with 58 percent of respondents who are not currently residents there saying they had a greater than 25 percent chance of moving there within the next three years. The United Kingdom, Canada, and Switzerland came next (between 25 percent and 35 percent of respondents). China,

despite its large investment and good performance in AI research, does not score high in attractiveness, with only 10 percent of nonresident respondents indicating an interest in immigrating there.

These results provide a crucial but incomplete picture of different countries’

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attractiveness to AI researchers. For example, out of the 524 survey respondents, 209 already lived in the United States when they took the survey, presumably because they considered it an attractive place to study or work. Their feelings about the United States are not represented in Figure 1, which looks only at researchers not already living in a given country.

To provide a better sense of a country's overall attractiveness, Table 1 in Appendix A shows the number of respondents who currently live in the country as well as the number of respondents who said they may move there in the next three years. For example, whereas the share of surveyed AI researchers who don't live in the United States but who may move there within three years is 58 percent (as seen in Figure 1), the share of researchers who may move there or who already live there is 78 percent. In other words, only 22 percent of the sample found the United States unattractive as a place to work or live (or is unlikely to move there for some other reason).<sup>9</sup>

Another way to look at attractiveness is by looking at the percentage of researchers in a country who were unlikely to move at all. Figure 4 in

Appendix A shows that 37 percent of U.S.-based researchers reported they were unlikely to move anywhere else, compared with between 23 percent and 14 percent for most other common countries of residence.

We also investigated whether researchers' likelihood of moving somewhere varied by where they came from. Figure 5 in Appendix A breaks down respondents' answers by the country where they did their undergraduate degree, which is a common and generally reliable proxy for a person's citizenship.<sup>10</sup> Some countries appeared broadly attractive. The United States was the top destination for almost all respondent categories—consistently scoring 50 percent or higher no matter where researchers did their undergraduate degree—and the United Kingdom was also popular (scoring between 23 percent and 71 percent). Other countries had more narrow appeal. For example, respondents who did their undergraduate degree in China were much more likely to report considering a move to China (roughly 50 percent) than respondents from any other country (around 5 percent on average). Similarly, France was popular mainly among European respondents. (Because there

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were only a limited number of respondents from some of these countries, not all of these differences are statistically significant; see Appendix A for a discussion.)

## AI Researchers' Immigration Decisions

Considering the differences in how likely AI researchers were to move to particular countries raises the question of what factors determine whether countries are considered attractive. To answer this question, respondents were asked: "When considering moving to work or study in a country that you don't currently work or study in full-time, what factors are important in your consideration?" Respondents saw a list of six factors commonly cited as key to immigration decisions in the high-skill immigration literature.<sup>11</sup> Respondents could select as many factors as they wanted, and they could also add other factors in an open textbox.<sup>12</sup>

Figure 2 shows the percentage of respondents who designated that a given factor is important to their moving decisions. Having a "good professional opportunities and environment" clearly topped the other factors, with 91 percent of respondents

selecting it as important. "Lifestyle and culture," "political climate," and "personal relations" were important to 79 percent, 66 percent, and 60 percent of respondents, respectively. "Ease of immigration and/or immigration incentives provided to move to destination country" were cited as important by a little under half, and least important were "current immigration difficulties in country of residence" (selected by 24 percent of all respondents).<sup>13</sup>

Figure 2 reports the results for all respondents, but looking at subcategories provides answers to additional questions. First, the decision factor "current immigration difficulties in country of residence" was mainly relevant to respondents who live in a country where they are not citizens. We do not have a direct measure of respondents' citizenship status, but we can impute citizenship by whether a respondent lives in the same country where they did their undergraduate degree. Figure 6 in Appendix A shows that about 40 percent of (imputed) noncitizen respondents in the United States reported that "current immigration difficulties" were a factor influencing their moving decisions, a higher percentage than in other countries.

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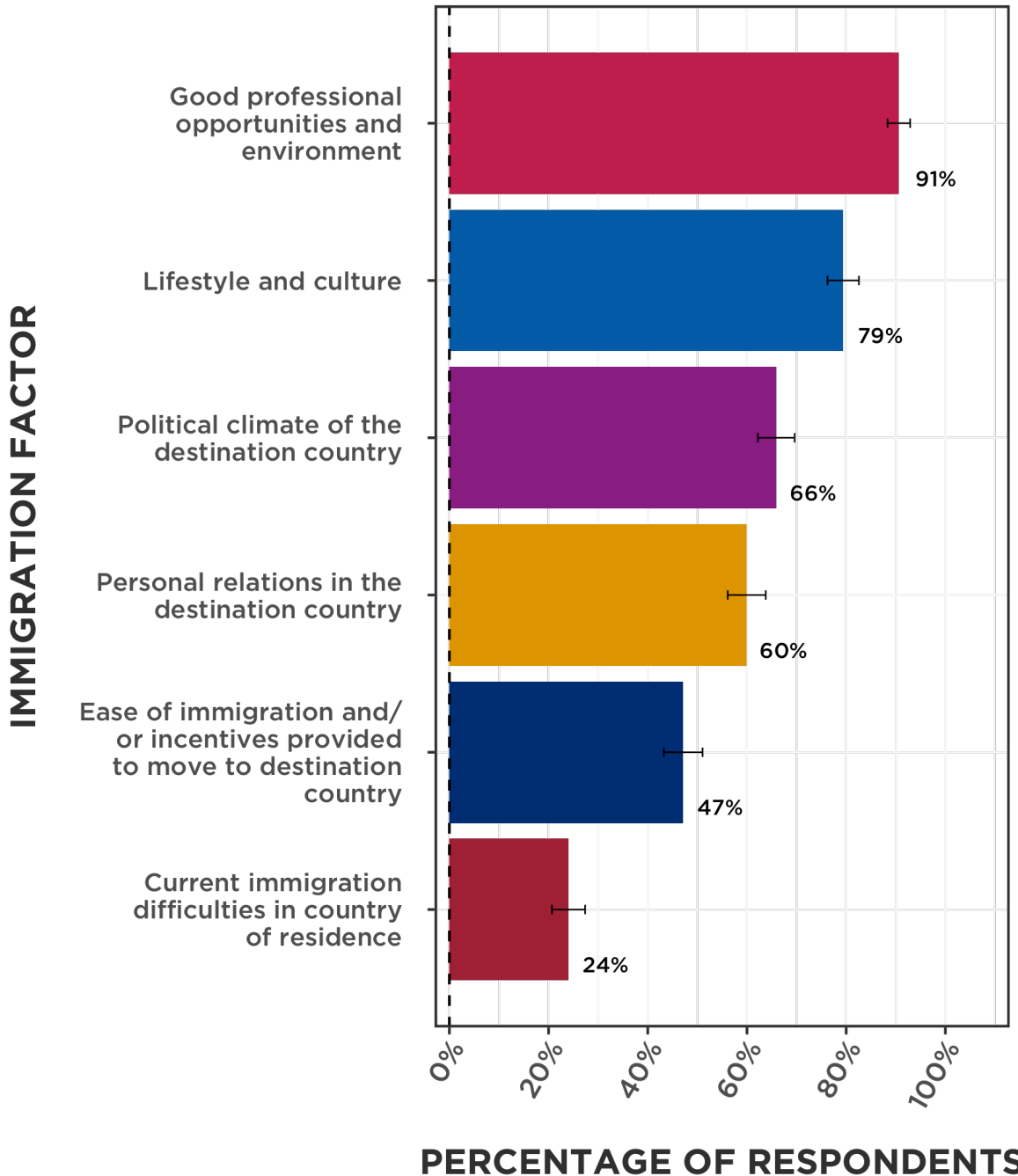


Figure 2 | What factors affect AI researchers' immigration decisions? | This graph shows what AI researchers report are important considerations in their immigration decisions. Respondents were asked what factors were important in their consideration of moving to work or study in a country that they don't currently work or study in full-time. Respondents were presented with the six options shown in the figure, alongside an "other" and "none of the above" option. Error bars represent 95 percent confidence intervals.

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Second, Figure 7 in Appendix A looks at whether the importance of these factors differed depending on where respondents live. Notably, respondents living in Asia viewed “personal relations” as less important than those living in the United States or Europe (36 percent compared with around 64 percent), and the same is true for “political climate of the destination country” (41 percent compared with around 66 percent). Yet there are also striking similarities across respondents who live in different regions. For example, “good professional opportunities” and “lifestyle” ranked first and second in importance among all regional respondent groups.

## AI Researchers’ Perceptions of Immigration Policy

National success in attracting and retaining international talent requires countries not only to be attractive, but also to have a legal immigration system that allows researchers and engineers to live and work there long-term. Given the efforts at reform and political tensions surrounding immigration policy in the United States and many other countries, it is critical to

understand how immigration policy issues factor into the decision-making process for talented AI researchers. This survey presented respondents with a list of potential issues that could affect AI research and asked respondents to indicate which, if any, applied to their country of residence. “Visa and immigration problems” were among the potential issues facing foreign researchers and students (see Appendix B for the full list of options).

Figure 3 shows what percentage of respondents said that “visa and immigration problems” were affecting AI research in their country of residence. Nearly 70 percent of those in the United States said that “visa and immigration problems” were a serious problem, compared with 44 percent of those in the United Kingdom, 29 percent of those in Canada, and less than 20 percent of those in other countries. Not all of these differences are statistically distinguishable because there were few respondents in some of these countries, but it is clear that AI researchers in the United States considered immigration a bigger issue than researchers elsewhere.

This finding is consistent with

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complaints by American researchers and companies that restrictive U.S. immigration policies hurt the U.S. AI sector and that other countries have better-designed immigration systems.<sup>14</sup> However, other interpretations are also

possible. For example, the fact that researchers in other countries rated immigration and visa issues as less of a problem for their AI sector could also be explained by lower levels of demand for AI talent in other countries (which

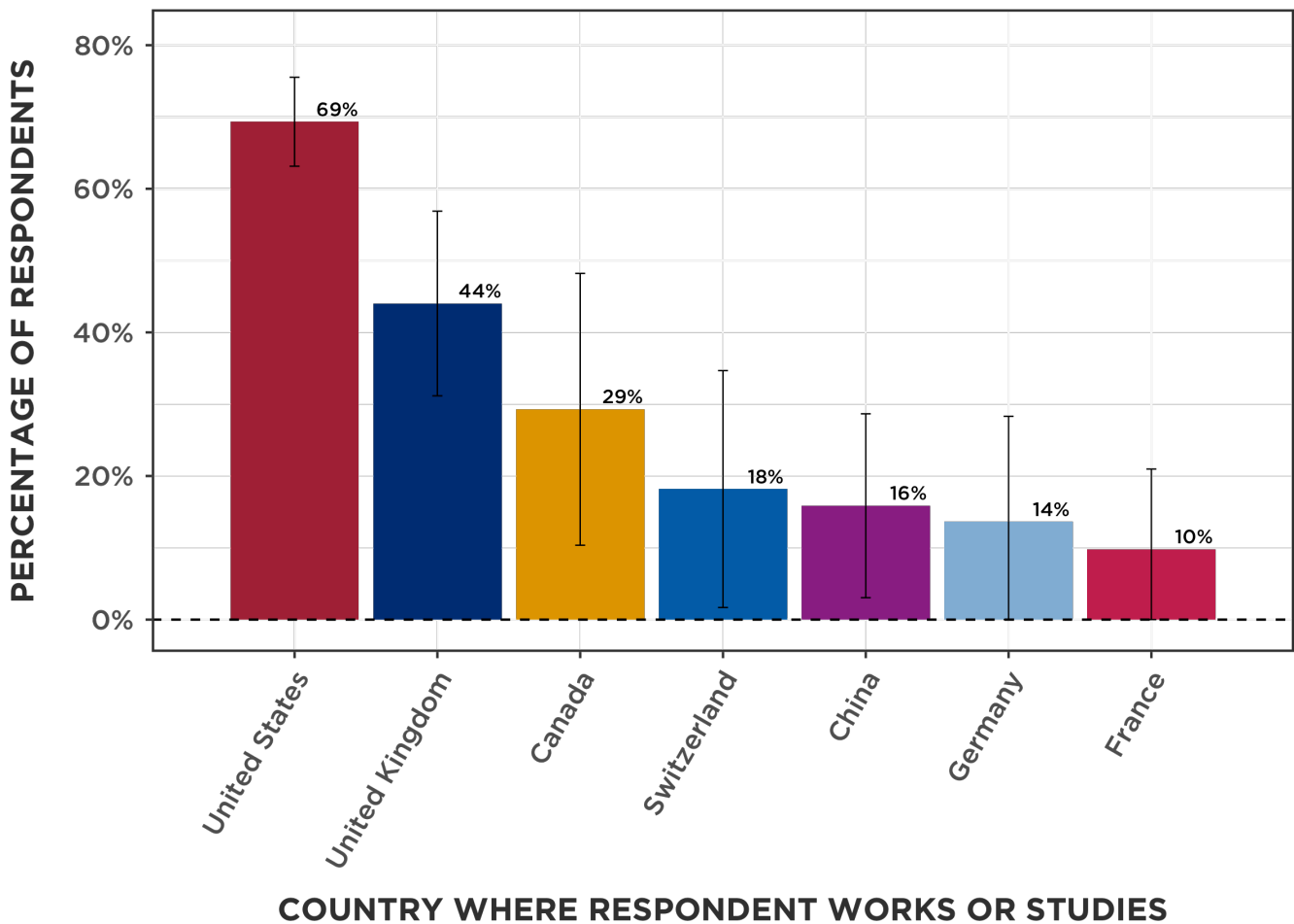


Figure 3 | Where are visa and immigration issues a serious problem for conducting AI research? | Respondents were asked what they considered to be serious problems for conducting high-quality AI research in their country of residence, with an option list that included seven issues (see Appendix B). Figure 3 presents the by-country breakdowns for one of these issues: the percentage of AI researchers living in each country who feel that visa and immigration issues are a serious problem for conducting high-quality AI research in their country of residence. Error bars represent 95 percent confidence intervals.

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would mean immigrants are not as needed). These data do not definitively distinguish between these explanations.

## Conclusion

The findings presented in this paper suggest that different countries face different immigration-related challenges that impact their ability to attract top AI researchers. For the United States, attractiveness is not a big issue. Many top AI researchers are already based in the United States, and nearly 60 percent of those who are not said they “may move to the United States in the near future.” However, immigration obstacles loom large for the United States: Nearly 70 percent of surveyed AI researchers based in the country said “immigration and visa issues” posed a serious problem for U.S. AI research, a considerably higher share than in any other country. This finding bolsters long-standing complaints by leading U.S. machine learning scientists, who have long argued that “visa restrictions have been one of the largest bottlenecks to our collective research productivity over the last few years” and that immigration obstacles are hurting the country’s AI sector.<sup>15</sup>

For countries like the United Kingdom and Canada, the story

is more mixed. The number of researchers there who said “immigration issues are a problem for AI research” is lower than in the United States but still considerable. Similarly, they were the second- and third-most attractive countries to AI researchers, respectively, with 35 percent and 28 percent of respondents saying they could move there soon. For the United Kingdom and Canada, then, a successful AI talent recruiting strategy would likely have to combine reductions in immigration barriers with targeted steps aimed at increasing the countries’ attractiveness.

For China and several other countries, the main challenge to attracting international AI talent seems to be low overall appeal, rather than their immigration system. Less than 20 percent of respondents in China said that “visa and immigration issues” are an important problem for the country’s AI ecosystem. However, only 10 percent of respondents not currently residing in China would consider moving there, and most of them appear to be Chinese citizens. Successful AI talent recruiting policies for countries like China will thus have to involve bolstering attractiveness. Judging by the factors

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respondents said are relevant to their immigration decisions, this would likely require addressing concerns about a mix of professional, cultural, and political issues.<sup>16</sup>

Future research on the nexus between immigration and AI talent should go deeper into these and other questions. First, similar questions should be asked not just of researchers publishing at top conferences, but also other AI professionals, such as engineers and entrepreneurs, who are likely to be underrepresented in our data. Second, to validate our findings, follow-up work could ask the same questions in different ways to see if responses are robust (e.g., eliciting immigration preferences through conjoint survey experiments as opposed to direct questions) or collect data on researchers' moving behavior to assess how predictive immigration intentions are of actual choices. Third, many more immigration-related questions could be asked, such as which specific visa and immigration problems are most worrisome to AI researchers.

## Appendix A: Additional Results

### Additional Results on AI Researchers' Likelihood of Migrating

Figure 1 showed how many respondents said that there was a decent chance (greater than 25 percent) that they would move to different countries within the next three years. Below are additional materials to contextualize the data presented in Figure 1.

First, Table 1 helps provide a better sense of a country's overall attractiveness. The first two columns show the raw frequencies and percentages already displayed in Figure 1, focusing on how many nonresident respondents said they may move to certain countries within the next three years. The third column shows the number of respondents who already live in a country, and therefore presumably find it an attractive place to work or live. The fourth column sums the first and third columns together, showing the total number respondents who either already live in a country or would consider moving there within the next three years. The fifth column converts this number into a share of all 439



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respondents who were asked this question.

Figure 4 provides another perspective on different countries' attractiveness to AI researchers. It shows what percentage of respondents already based in a country said

they were unlikely (less than 25 percent chance) to move to any other country within the next three years. For example, 37 percent of researchers in the United States answered "none of these" to the question about future migration destinations, compared with 23 percent or

	1	2	3	4	5
	Number of nonresident respondents with greater than 25% likelihood of moving within three years	Percent of nonresident respondents with greater than 25% likelihood of moving within three years	Number of respondents based in country	Number of respondents who are either based in a country or indicate interest in moving there	Percent of respondents who are either based in a country or indicate interest in moving there
U.S.	134	58%	209	343	78%
U.K.	133	35%	54	187	43%
Canada	114	28%	22	136	31%
Switzerland	105	25%	22	127	29%
France	66	16%	25	91	21%
China	41	10%	21	62	14%
Singapore	34	8%	3	37	9%
Japan	26	6%	7	33	7%
Australia	25	6%	5	30	7%
South Korea	12	3%	11	23	5%
Israel	9	2%	4	13	3%

Table 1 | Number of current residents and potential immigrants across different destination countries | Table 1 displays countries selected as answer options for the survey question (see Appendix B); at least one respondent lived in an additional 16 countries not shown here (none of those countries hosted more than six respondents). Data on country of residence was missing for 72 respondents. The denominator used to calculate the percentage in column 2 fluctuates by country due to a varying number of nonresident respondents. The denominator used to calculate the percentages in column 5 is 434, representing the number of people who answered both the work location question and the question concerning potential moving destinations.



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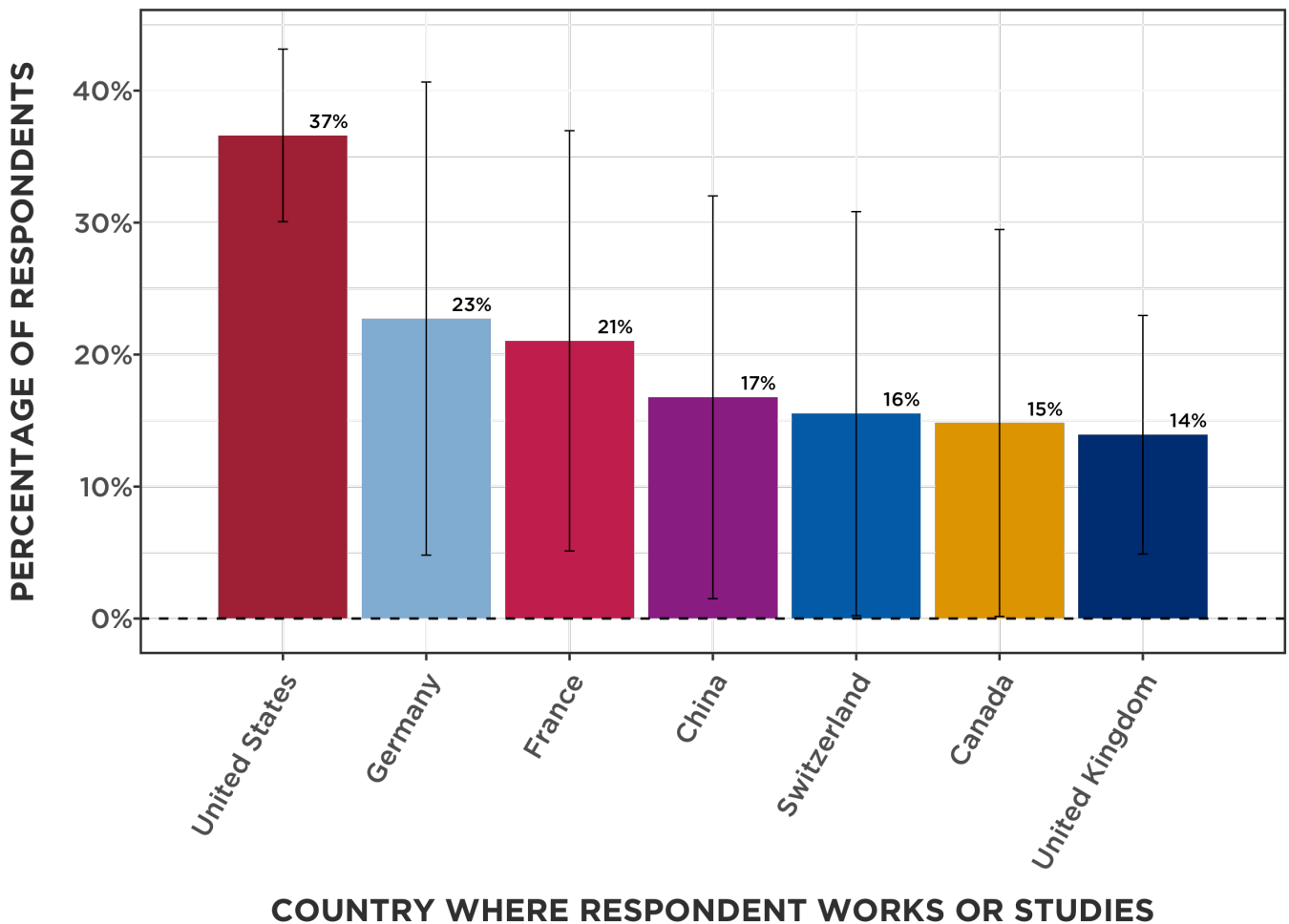


Figure 4 | Which countries are AI researchers unlikely to leave? | Respondents were asked where they had a greater than 25 percent chance of moving to for work or study within the next three years. They were presented with a list of countries to choose from as well as “none of these” and “other” options (see Appendix B for the full list). This figure shows the percentage of AI researchers who chose the option “none of these,” sorted by current country of residence. Error bars represent 95 percent confidence intervals.

fewer of respondents based in other countries.

Figure 5 considers what destination countries are most attractive depending on where respondents did their undergraduate degree. Country of undergraduate degree is

often used as a proxy for nationality when data on actual nationality is not available, because the vast majority of students do their bachelor’s in their home country.<sup>17</sup> Figure 5 breaks out respondents who received their undergraduate degrees in the United States,

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China, India, the United Kingdom, and Germany—the five most common undergraduate countries (see Table 2 in Appendix B)—plus a residual “other” category. Some countries, such as the United States and the United Kingdom, had broad appeal across all respondent groups. Other countries, such as China and to some extent France, were

attractive only to researchers who appear to hail from those countries or the same region.

## Additional Results on AI Researchers’ Immigration Decisions

Figure 2 in the paper displayed the factors that respondents considered important to their immigration decisions. The two

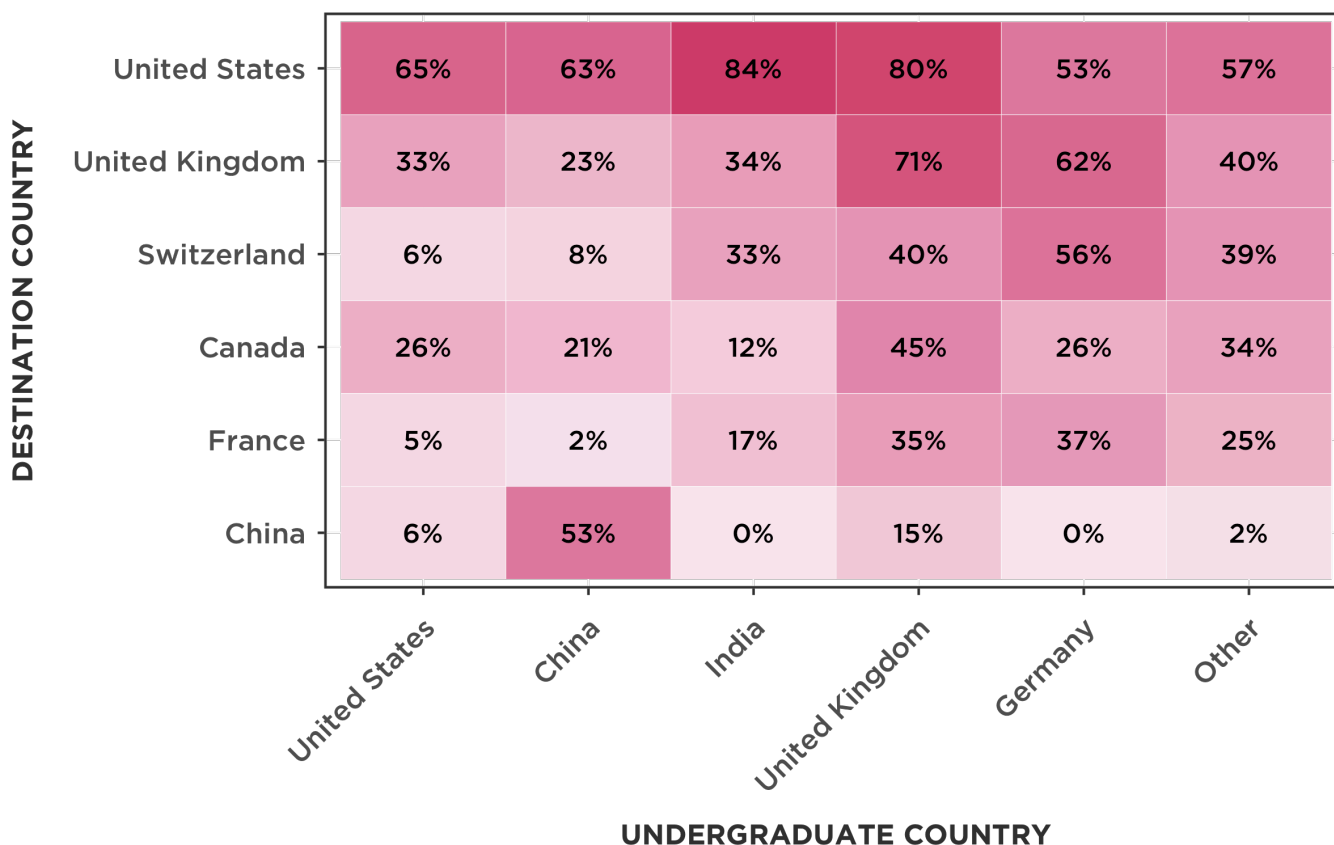


Figure 5 | Which countries are appealing to AI researchers from a broad range of backgrounds? | Respondents were asked where they had a greater than 25 percent chance of moving to for work or study within the next three years. They were presented with a list of countries to choose from as well as “none of these” and “other” options (see Appendix B for the full list). This figure shows the percentage of AI researchers who selected the six most popular of the possible destination countries, broken down by where respondents did their undergraduate degree.

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figures below analyze specific respondent subgroups that provide additional insights into different AI researchers' decisions.

First, Figure 2 showed that 24 percent of all respondents reported “current immigration difficulties in country of residence” as a factor influencing their decision to move. However, in practice, this factor was relevant only to respondents who are not citizens in their current country of residence. It is therefore instructive to look at this particular factor only among noncitizens. We do not have a direct measure of respondents' citizenship status, but we can impute citizenship by whether a respondent lives in the same country where they did their undergraduate degree. There are four countries where there are more than 10 (imputed) noncitizens in the respondent pool: the United States, Canada, the United Kingdom, and Switzerland.<sup>18</sup>

For these four countries, Figure 6 shows the percentage of noncitizens—that is, respondents who did their undergraduate degree in different countries—who reported that current immigration difficulties are an important factor for their

immigration decisions. Noncitizens in the United States were most likely to say this is the case (40 percent), while noncitizens in Switzerland were least likely to (14 percent).

Second, Figure 2 considered all respondents regardless of their location. Figure 7 below shows the factors that respondents considered important to their immigration decisions broken out by region of current residence: North America, Europe, or Asia. The most notable differences across regions are in how important “personal relations” and the “political climate” in the destination country are, two factors considered much less important by respondents living in Asia. Importance scores for the other factors are mostly similar.

## Appendix B: Sample and Survey Methodology

This paper draws on data from an AI expert survey fielded by the Centre for the Governance of AI at the Future of Humanity Institute at the University of Oxford. The survey was circulated via email from mid-September to mid-October 2019 to 3,030 machine learning researchers who had papers

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accepted at either NeurIPS (2018, 2015) or ICML (2019, 2015), two top conferences in the field. Overall, 524 researchers responded to the survey (response rate: 17 percent).

We collected data on a variety of respondents' demographic characteristics. For example, most live in Western countries (see Table 1), although China and India were the second- and third-most common countries

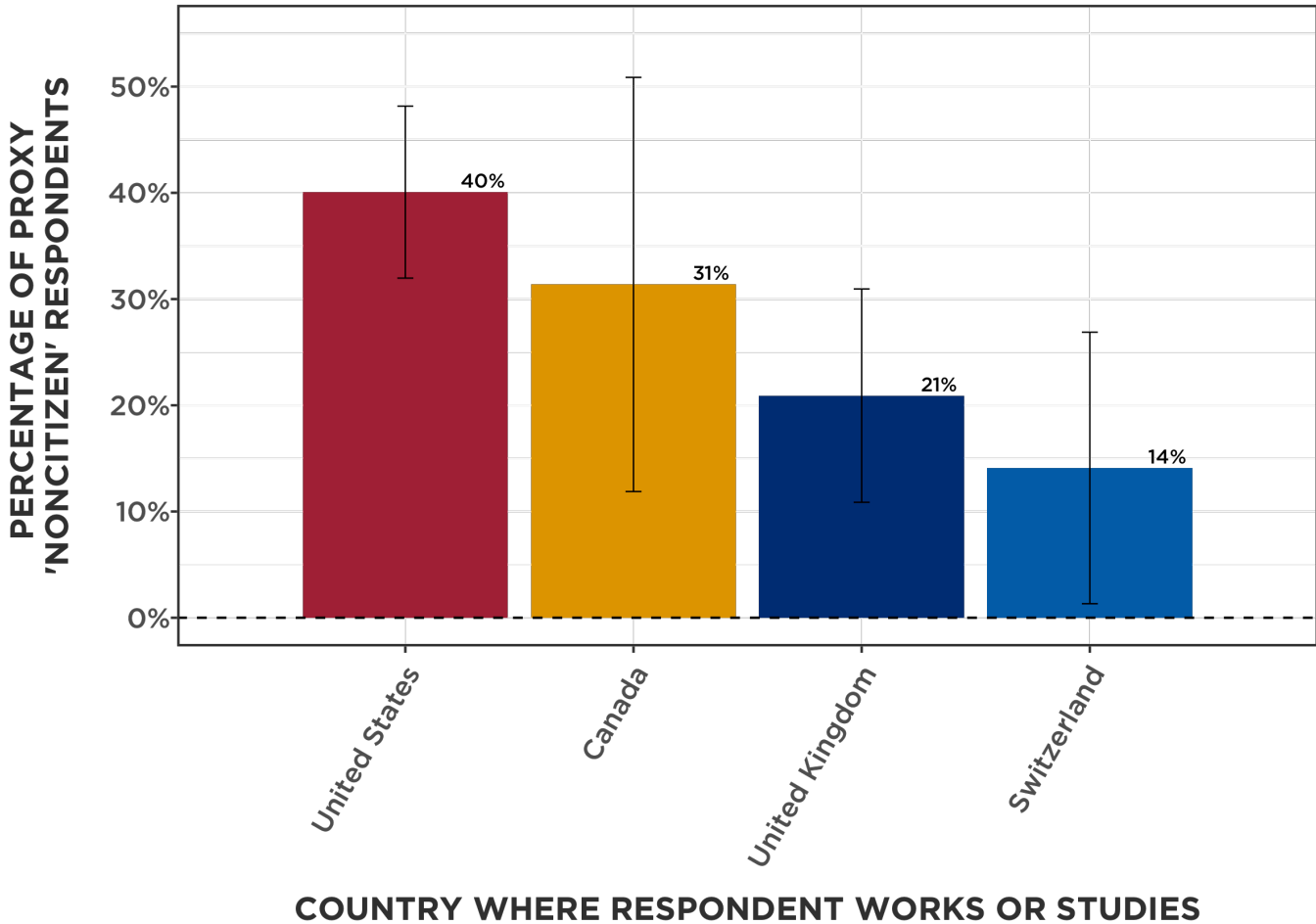


Figure 6 | In which countries are noncitizens most likely to say that current immigration difficulties are an important factor influencing their immigration decisions? | Respondents were asked what factors were important in their consideration of moving to work or study in a country that they don't currently work or study in full-time. Respondents were presented with six options, one of which was "current immigration difficulties in country of residence." This figure shows the percentage of imputed noncitizen respondents who said that this factor was important to their consideration. Figure 6 shows this percentage across the four countries that had more than 10 imputed noncitizens. Error bars represent 95 percent confidence intervals.

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for respondents to have received their undergraduate degree, respectively (Table 2). Most respondents are relatively young, with the average respondent having received

their undergraduate degree in 2009 (Table 3). Finally, the majority of respondents work in academia, though a significant minority work in industry (Table 4).

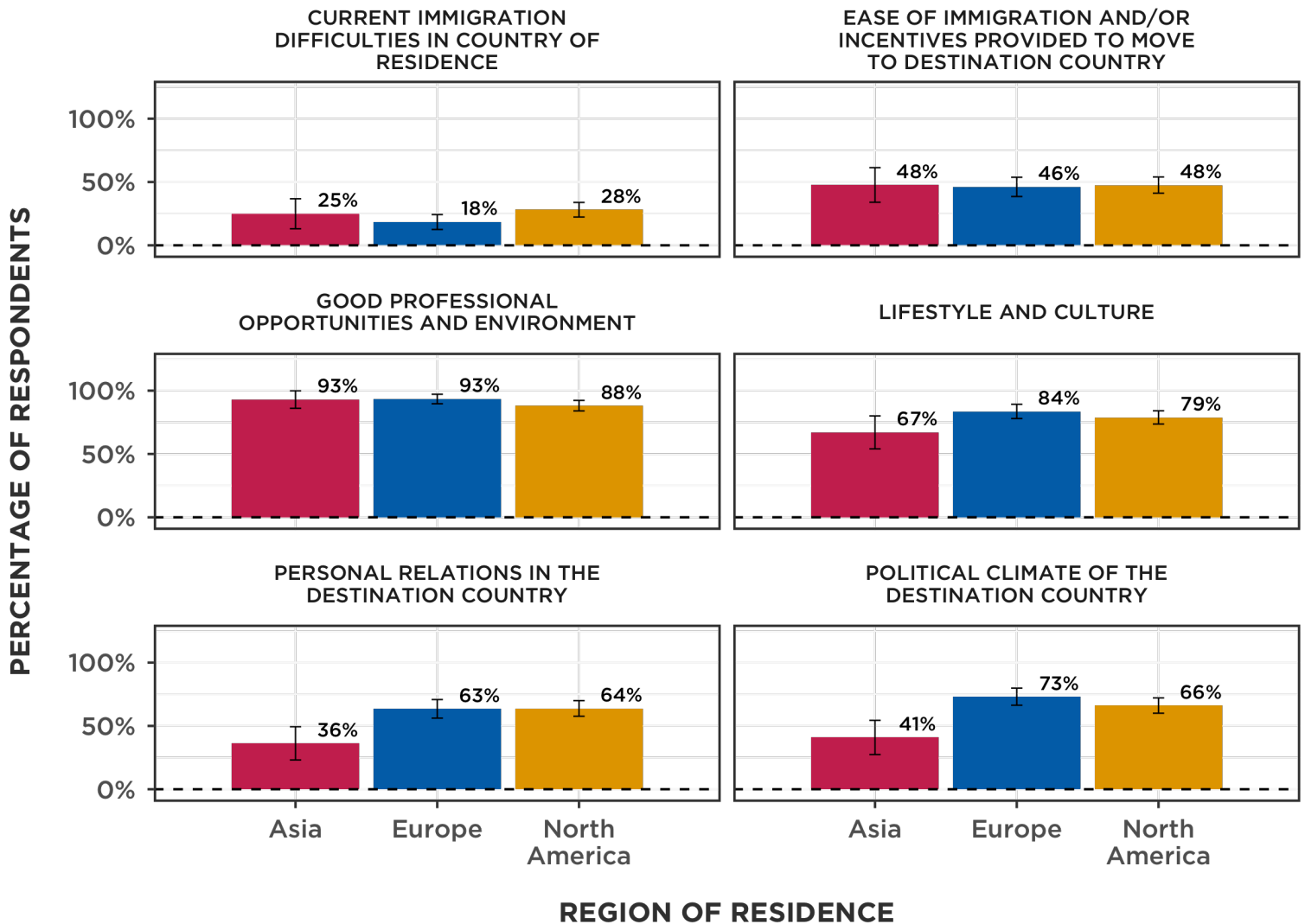


Figure 7 | Regional differences in what factors affect AI researchers' immigration decisions | Respondents were asked what factors were important in their consideration of moving to work or study in a country that they don't currently work or study in full-time. Respondents were presented with the six options shown in Figure 7. The figure shows the percentage of AI researchers who reported that these six factors were important, broken down by their current region of residence (Asia, Europe, and North America). Error bars represent 95 percent confidence intervals.

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Country of undergraduate degree	Number of respondents
United States	115
China	84
India	43
United Kingdom	23
Germany	21
France	20
Iran	18
Italy	17
South Korea	16
Canada	14

Table 2 | Country where respondents received their undergraduate degree (top 10) | There were an additional 37 countries in which seven or fewer respondents received their undergraduate degree. Data were missing for 70 respondents.

Statistic	Year
Mean	2009
Median	2011
Minimum	1974
Max	2019

Table 3 | Year respondents completed their undergraduate degree | Data were missing for 120 of the respondents.

Employment sector	Number of respondents
Only academic	360
Only industry	109

Table 4 | Respondents' sector(s) of current employment | "Other" primarily involves government and nonprofit organizations. Respondents could report multiple affiliations.

## Respondent Representativeness

Out of the 3,030 researchers contacted, 524 researchers (17 percent) completed the survey. This raises questions about representativeness: Are those who responded systematically different from those who did not? To assess this question, we collected background data on a random sample of 446 nonrespondents using information publicly available online (e.g., from LinkedIn).

We compared respondents with nonrespondents on a range of dimensions, including gender; the region where they did their undergraduate degree, their Ph.D. degree, and where they are currently employed; the proportion employed in academia and industry or still enrolled in a degree program; and their logged citation counts and H-index. Respondents closely resemble

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nonrespondents on almost all of these dimensions. The only statistically significant differences between the groups are in employment sector (respondents were more slightly likely to work in academia than nonrespondents) and H-index (respondents with a higher H-index were slightly less likely to respond). For a full comparison table, see Appendix B of our companion paper “Ethics and Governance of Artificial Intelligence: Evidence from a Survey of Machine Learning Researchers.”<sup>19</sup>

## Survey Questions

We reported results for the following questions:

- **“Of the following countries, which would you have a greater than 25% likelihood of moving to for work or study in the next three years?”** The answer options presented to respondents (in randomized order) were:
  - o United States
  - o United Kingdom
  - o China
  - o Australia
  - o Singapore
  - o Japan
  - o Canada
  - o South Korea
  - o Israel
  - o France
  - o Switzerland

- o Other [textbox]
- o None of these

These countries were selected based on studies of AI talent that show these countries as the top destinations for AI researchers.<sup>20</sup>

- **“When considering moving to work or study in a country that you don’t currently work or study in full-time, what factors are important in your consideration?”** The answer options presented to respondents (in randomized order) were:
  - o Current immigration difficulties in country of residence
  - o Ease of immigration and/or incentives provided to move to destination country
  - o Personal relations in the destination country (e.g., friends and family)
  - o Good professional opportunities and environment (e.g., you are offered a job at an attractive organization)
  - o Lifestyle and culture
  - o Political climate of the destination country
  - o Other: [textbox]
  - o None of the above

As noted above, these options were chosen based on a literature review of prior immigration-related surveys among researchers and other



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high-skill immigrants.<sup>21</sup>

- **“Which of the following, if any, are serious problems for conducting high-quality AI research in <INSERT NAME OF YOUR COUNTRY OF WORK> today?”** The answer

options presented to respondents (in randomized order) were:

- o Lack of government funding for AI research
- o Lack of corporate funding for AI research
- o Lack of funding for training students
- o Visa and immigration problems facing foreign researchers or students who want to work or study in <INSERT NAME OF YOUR COUNTRY OF WORK>
- o Lack of a successful ecosystem for AI startups
- o Not enough top researchers and labs
- o The political climate in <INSERT NAME OF YOUR COUNTRY OF WORK> is not conducive to AI research
- o Other: [textbox]
- o There are no serious problems

Other sections of the survey asked about AI governance challenges, AI progress forecasts and milestones, research priorities and norms, and employment preferences, among other topics. The median respondent took 17 minutes to complete the survey.

The Centre for the Governance of AI will publish further reports on the full survey results.<sup>22</sup>

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## Endnotes

1. Remco Zwetsloot, Roxanne Heston, and Zachary Arnold, Strengthening the U.S. AI Workforce: A Policy and Research Agenda (Washington, D.C.: Center for Security and Emerging Technology, September 2019), <https://cset.georgetown.edu/research/strengthening-the-u-s-ai-workforce/>.
2. See, e.g., Association for the Advancement of Artificial Intelligence, “AAAI Response to NITRD RFI: National Artificial Intelligence Research and Development Strategic Plan,” October 26, 2018, <https://www.nitrd.gov/rfi/ai/2018/AI-RFI-Response-2018-Yolanda-Gil-AAAI.pdf>; Oren Etzioni, “What Trump’s Executive Order on AI Is Missing,” Wired, February 13, 2019, <https://www.wired.com/story/what-trumps-executive-order-on-ai-is-missing/>.
3. Tina Huang and Zachary Arnold, Immigration Policy and the Global Competition for AI Talent (Washington, D.C.: Center for Security and Emerging Technology, June 2020), <https://cset.georgetown.edu/research/immigration-policy-and-the-global-competition-for-ai-talent/>.
4. Our study complements a recent survey by the Center for Security and Emerging Technology that looked specifically at the immigration preferences of AI Ph.D. graduates from U.S. universities; see Catherine Aiken, James Dunham, and Remco Zwetsloot, Immigration Pathways and Plans of AI Talent: Findings from a CSET Survey of Artificial Intelligence PhDs from U.S. Universities (Washington, D.C.: Center for Security and Emerging Technology, September 2020), <https://cset.georgetown.edu/research/immigration-pathways-and-plans-of-ai-talent/>.
5. For the results of the 2015–2016 expert survey, see Katja Grace, John Salvatier, Allan Dafoe, et al., “When Will AI Exceed Human Performance? Evidence from AI Experts,” *Journal of Artificial Intelligence Research*, 62: 729-754, July 2018, <https://doi.org/10.1613/jair.1.11222>. This previous expert survey did not ask immigration-related questions.
6. We incentivized responses through a lottery: One out of every 10 researchers who completed the survey received a \$250 gift card.
7. The Centre for the Governance of AI will publish the full survey results. An analysis of the survey questions focused on ethics and governance can be found at Baobao Zhang, Markus Anderljung, Lauren Khan, et al., “Ethics and Governance of Artificial Intelligence: Evidence from a Survey of Machine Learning Researchers,” Working Paper, October 2020, <https://osf.io/pnvfd/>.
8. These countries were selected based on studies of AI talent that showed they were the top destinations for AI researchers. Jean-Francois Gagne, “Global AI Talent Report 2019,” <https://jfgagne.ai/talent-2019/>; Artificial Intelligence Index, “2019 Annual Report,” [https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai\\_index\\_2019\\_report.pdf](https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai_index_2019_report.pdf); Zwetsloot et al., Keeping Top AI Talent in the United States, Figure 9.
9. Note that these results are not necessarily representative of the views of AI researchers as a whole. The response rate of the survey was 17 percent, and we do not know why some contacted researchers filled out the survey and why others did not, so the results should be interpreted with caution. For example, it could be that researchers who had unfavorable attitudes toward the United States or the United Kingdom were less likely to respond to a survey sent out by

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universities from those countries. Our analysis comparing respondents with nonrespondents finds little imbalance in terms of demographic characteristics (Appendix B), but we do not have data that allow us to compare response rates across attitudinal variables.

10. Country of undergraduate degree is a common and validated proxy for nationality when actual nationality data is not available, as discussed in Appendix A.

11. See, e.g., Xueying Han and Richard P. Appelbaum, Will They Stay or Will They Go? International STEM Students Are Up for Grabs (Kansas City, MO: Ewing Marion Kauffman Foundation: July 2016), <https://eric.ed.gov/?id=ED570660>; Mark Musumba, Yanhong H. Jin, and James W. Mjelde, “Factors Influencing Career Location Preferences of International Graduate Students in the United States,” *Education Economics*, 19(5): 501-517, September 2009, <https://doi.org/10.1080/09645290903102902>. For a summary of this research, see Remco Zwetsloot, James Dunham, Zachary Arnold, and Tina Huang, Keeping Top AI Talent in the United States: Findings and Policy Options for International Graduate Student Retention (Washington, D.C.: Center for Security and Emerging Technology: December 2019), 10-12, <https://cset.georgetown.edu/wp-content/uploads/Keeping-Top-AI-Talent-in-the-United-States.pdf>. More potential factors could of course have been added, but the number of included factors was limited by the need to avoid overburdening respondents.

12. Fourteen respondents indicated other factors that were important to them in the open-ended textbox. Factors that were mentioned multiple times included distance from family and friends (mentioned four times), political issues or inequality (three times), income and quality of life (twice), and the health care system (twice).

13. There are at least two ways to interpret the “current immigration difficulties” finding. It could be that respondents are not encountering difficulties—for example, because they are already permanent residents or citizens. Or respondents may be encountering difficulties but not letting those influence their immigration decisions. Unfortunately, the phrasing of the question does not allow us to distinguish between these two interpretations.

14. For data and statements, see Zachary Arnold, Roxanne Heston, Remco Zwetsloot, and Tina Huang, Immigration Policy and the U.S. AI Sector (Washington, D.C.: Center for Security and Emerging Technology, September 2019), <https://cset.georgetown.edu/research/immigration-policy-and-the-u-s-ai-sector/>; Tina Huang and Zachary Arnold, Immigration Policy and the Global Competition for AI Talent (Washington, D.C.: Center for Security and Emerging Technology, June 2020), <https://cset.georgetown.edu/research/immigration-policy-and-the-global-competition-for-ai-talent/>.

15. For AI researcher statements, see Zachary Arnold, “Misguided Immigration Policies Are Endangering America’s AI Edge,” *Defense One*, November 18, 2019, <https://www.defenseone.com/ideas/2019/11/misguided-immigration-policies-are-endangering-americas-ai-edge/161366/>. The quote comes from Ian Goodfellow, then a research scientist at Google Brain and currently director for machine learning at Apple.

16. For a survey of 2,300 STEM researchers whose findings reinforce this takeaway, see Richard van Noorden, “Global Mobility: Science on the Move,” *Nature*, October 17, 2012, <https://www.nature.com/news/global-mobility-science-on-the-move-1.11602>.

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17. The most likely source of error in using the country of undergraduate degree as a proxy for nationality is Chinese and Indian students, who study abroad—mostly for graduate school but also for their bachelor’s—at much higher rates than students from other countries. This means that some Chinese and Indian students will be misclassified as, for example, U.S., Canadian, or British nationals. Past studies have found that error rates are generally 10 to 20 percent at most; see, for example, Zwetsloot, et al., *Keeping Top AI Talent*, fn. 24. Moreover, to the extent that there is an error, the direction of bias is predictable. For example, because Chinese citizens are more likely to say that they might move to China, measurement error would likely lead us to overestimate the attractiveness of China to U.S. or U.K. citizens.

18. The United States is home to 108 (imputed) noncitizens, the United Kingdom to 26, Switzerland to 17, and Canada to 15.

19. Asian countries present in our dataset are China, South Korea, Japan, India, and Singapore. Russia is included in Europe.

20. Zhang, et. al., “Ethics and Governance of Artificial Intelligence: Evidence from a Survey of Machine Learning Researchers.”

21. Jean-Francois Gagne, “Global AI Talent Report 2019,” <https://jfgagne.ai/talent-2019/>; Artificial Intelligence Index, “2019 Annual Report,” [https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai\\_index\\_2019\\_report.pdf](https://hai.stanford.edu/sites/g/files/sbiybj10986/f/ai_index_2019_report.pdf); Zwetsloot, et al., “Keeping Top AI Talent in the United States,” Figure 9.

22. Including Zhang, et al., “Ethics and Governance of Artificial Intelligence: Evidence from a Survey of Machine Learning Researchers.”



**PERRY  
WORLD  
HOUSE**  
UNIVERSITY of PENNSYLVANIA

**UNIVERSITY OF PENNSYLVANIA  
PERRY WORLD HOUSE**

**3803 LOCUST WALK,  
PHILADELPHIA, PA 19104  
215.573.5730**