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Newcomers and novelty

The contribution of immigrant inventors to U.S. patents, 2000-2012



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Project team

This report was prepared by the Office of the Chief Economist at the United States Patent and Trademark Office (USPTO), a unit of the USPTO's Office of Policy and International Affairs.

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Abstract

This report examines the participation and output of immigrant inventors in the U.S. patent system, focusing on filing years from 2000 through 2012. The analysis uses the citizenship data in USPTO inventor oaths and declarations to identify the foreign countries that immigrant inventor-patentees came from, and uses PatentsView data to track the U.S. counties in which they were located. The findings document the increasing share of domestic patents with at least one immigrant inventor, the high rate of collaborations between U.S. citizens and immigrants in inventor teams, and the above-average influence of patents produced by these collaborations. In addition to these trends, the report explores the dimensions of geography, time, and technology as it highlights the contributions of immigrant inventors to U.S. innovation.

Introduction

The United States is known as a “nation of immigrants”¹ and these immigrants have participated in the U.S. patent system throughout the country’s history. Recent inventors who emigrated to the United States include two Nobel Prize winners: Hungarian American Katalin Karikó, inventor of the modified mRNA technology that laid the foundation for mRNA vaccines (U.S. Patent No. 8,278,036), and Japanese American Shuji Nakamura, inventor of the blue LED (U.S. Patent No. 5,290,393). The contributions of immigrants are clear even in the earliest historical periods of U.S. invention, with inventors such as Canadian American Alexander Graham Bell, who invented the telephone (U.S. Patent No. 174,465). These examples illustrate the core elements of the intellectual property data that this report highlights: the combination of inventors’ countries of origin, the characteristics of their patents at filing, and the subsequent impact of their inventions.

1. See Kennedy (1958).

Key findings

- The share of immigrant inventors increased over time, from 14% of U.S. inventor-patentees in 2000 to 22% in 2012. In 2012, immigrant inventor-patentees contributed to over 40% of all domestic patents.
- Over the 2000-2012 time period, immigrant inventor-patentees came from all over the world, with India (20%), China (15%), and Canada (10%) as the most frequent countries of origin.
- The Immigrant Inventor Rate (IIR) was higher in cities and near the U.S. coastline, and lower in the interior of the country.
- Immigrant inventors produced most of their patents (71%) in collaboration with one or more U.S. citizen inventor-patentees.
- Collaborations between U.S. citizens and immigrants generated higher-cited patents, with 15% more citations per patent than the next-highest category.
- Immigrant inventor-patentees were most active in the technology of electrical engineering, where they contributed to 42% of granted patents.

By moving beyond individual examples to a comprehensive analysis of immigrant inventors, this report contributes to a growing body of work looking at the role of immigrants in the U.S. innovation ecosystem. Scholars from Stanford University estimate that immigrant inventors make larger-than-average contributions to domestic patenting, in terms of both quantity and quality.² Their research also indicates that immigrant inventor-patentees tend to amplify the productivity of U.S.-born inventors. This suggests that immigrant inventors play an important role in driving higher rates of innovation in the United States, ultimately leading to greater economic growth. This report builds on prior work by providing novel insights into immigrant inventor-patentees, including analyses of their countries of origin and the distribution of their patents across technologies.

To better understand the origins and contributions of immigrant inventor-patentees, this report studies the patenting by immigrants listed as inventors on granted U.S. patents filed from 2000 through 2012, which is the only time period during which all the necessary data are available.³ Specifically, the analysis uses a novel dataset of inventors' oaths and declarations submitted as part of the patent application process to identify citizenship,⁴ and adds patent-specific information such as location and technology from PatentsView.⁵ While this report uses historical data, its main findings are likely to continue to apply in the present. Importantly, the historical data allow for sufficient time to analyze post-grant outcomes such as citations and maintenance fee payments, providing important insights into the long-term value of the patented inventions in the sample.

Patent data collected by the United States Patent and Trademark Office (USPTO) provide two important data elements that can be used to identify and analyze immigrants' participation in invention and patenting. First, before the implementation of the relevant provisions of the Leahy-Smith America Invents Act (AIA) on September 16, 2012,⁶ inventors were required to submit oaths or declarations (or substitute statements) declaring their country of citizenship at the time of filing.⁷ Second, PatentsView provides the city and state of inventors' residency. In combination, these elements define immigrant inventor-patentees as inventors listed on granted U.S. patents who were located in the United States but who were not (initially) U.S. citizens.⁸

2. See Bernstein et al. (2022).

3. As discussed in the next section, immigrants are defined as individuals who live in the United States, but who declare non-U.S. citizenships. The information needed to identify immigrants is not available after the implementation of the Leahy-Smith America Invents Act on September 16, 2012. Similarly, prior to 2000, relatively few inventor citizenship data points have been digitized and incorporated into the USPTO's internal databases.

4. See section 602 Oaths and Declarations, *Manual of Patent Examining Procedure* (Washington, DC: USPTO 2022), www.uspto.gov/web/offices/pac/mpep/s602.html.

5. PatentsView (www.patentsview.org) is a web-based data improvement platform supported by the USPTO Office of the Chief Economist.

6. The Leahy-Smith America Invents Act, Pub. L. No. 112-29, was enacted on Sept. 16, 2011, with an effective date one year after enactment. For details, see www.uspto.gov/sites/default/files/aia_implementation/20110916-pub-112-29.pdf. The USPTO also maintains an AIA web resource page of [frequently asked questions](#).

7. Following the implementation of the America Invents Act, an inventor is no longer required to (a) state that he or she is the first inventor of the claimed invention, (b) state that the application filing is made without deceptive intent, or (c) provide his or her country of citizenship.

8. Although practical, this definition may capture non-U.S. citizens visiting the United States temporarily, thereby over-counting immigrant inventor patentees. However, under-counting is most likely: immigrants who became naturalized citizens before filing their patent applications cannot be distinguished from U.S.-born inventor-patentees in the available data.

This report uses two complementary metrics to track the participation of immigrants in U.S. patenting over time. The first metric calculates the share of immigrants among all inventor-patentees, which this report defines as the immigrant inventor rate (IIR). The IIR focuses on unique individuals, regardless of the number of patents that list them as inventors. Therefore, this metric tracks the participation of immigrant inventor-patentees as an “input” to knowledge production and innovation. The second metric tracks the “output” of immigrant inventors by counting granted patents with at least one immigrant inventor-patentee, which is also influenced by the size and composition of inventor-patentee teams.

Using these metrics, this report focuses on six central research questions. The first three explore foundational aspects of immigrant inventor-patentees: How many such immigrants are there? Where do they come from? Where in the United States do they live? These questions are relevant for any analysis of immigrants, and the data collected for this report make it possible to compare immigrant inventor-patentees with the broader foreign-born U.S. population. The next three research questions focus on contributions: What kind of inventor teams do immigrants join? How impactful are the inventions they produce? In which technologies do they patent? These questions point to the specific inventions that immigrants have patented, and highlight the importance of collaborations between immigrants and U.S. citizens.

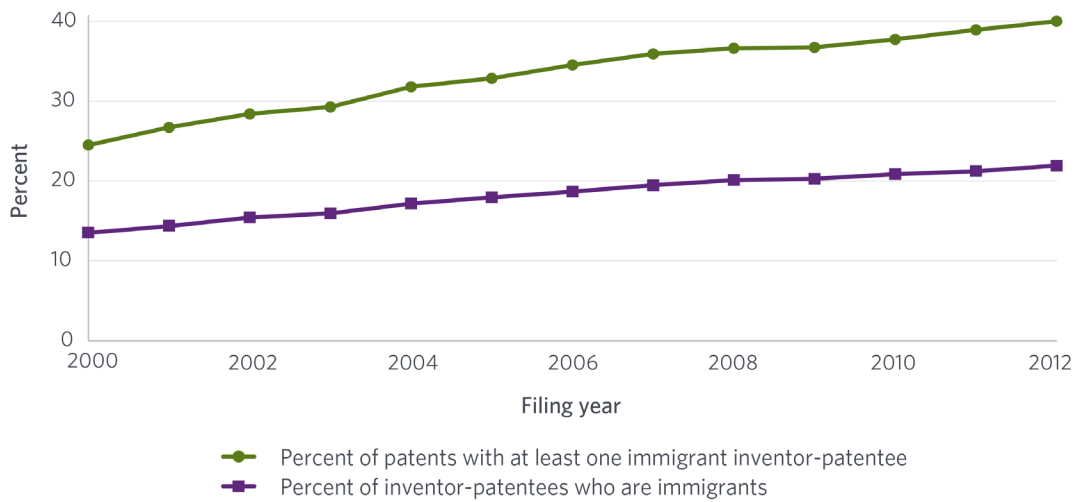
How has the share of immigrant inventor-patentees changed over time?

This report finds 138,157 unique immigrant inventor-patentees on granted patents filed from 2000 through 2012. These individuals accounted for approximately 17% of all U.S.-based inventor-patentees during this period; however, this average value masks significant increases in immigrants’ participation in the patent system over time. Both the share of immigrant inventor-patentees and the share of immigrant patents grew substantially between filing years 2000 and 2012 (Figure 1). The IIR rose from 13.5% in 2000 to 21.9% in 2012. Similarly, the share of domestic patents with at least one immigrant inventor increased from 24.5% in 2000 to 40.0% in 2012. Taken together, these trends indicate a near-doubling of both the “input” and “output” of immigrant inventor-patentees over a 12-year time horizon.⁹ The rising participation of immigrants in domestic patenting coincided with a more gradual but multi-decade rise in the percentage of foreign-born individuals in the United States, from a low of 4.7% in the 1970 Census to 13.9% in the 2022 American Community Survey.¹⁰

9. When looking at raw numbers instead of percentages, both immigrant inventor-patentees and patents with at least one immigrant inventor doubled from 2000 to 2012.

10. See [Figure 1](#) in Azari et al. (2024).

Figure 1: Patenting and participation by U.S.-based immigrant inventor-patentees, 2000–2012



Source: Author's estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

The IIR levels of approximately 20% to 22% in filing years 2007 through 2012 are consistent with other benchmarks of immigrants' education and employment in science, technology, engineering, and mathematics (STEM) fields. In 2010, foreign-born workers made up 21.3% of STEM employees with a bachelor's degree or higher in the United States.¹¹ The data suggest that immigrant participation as inventor-patentees was roughly proportional to their share of the pipeline of STEM education and employment.

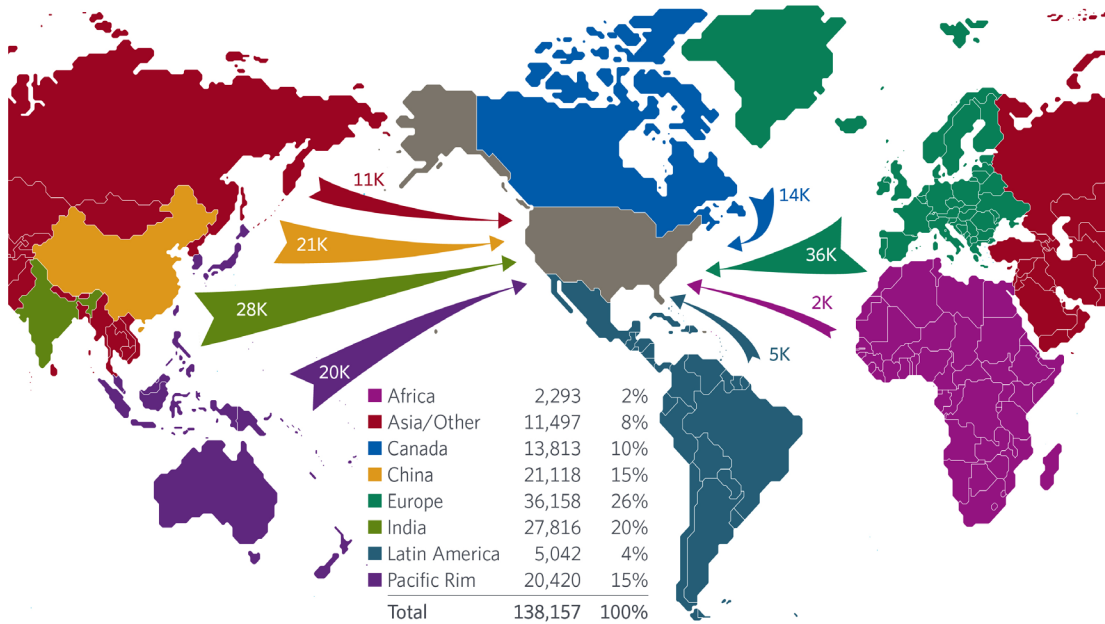
Where do immigrant inventor-patentees come from?

Immigrants come to the United States from around the world. Figure 2 portrays the geographic origins of immigrant inventor-patentees in the United States, based on the first-available citizenship entry in the inventor oaths of their patent applications. The top three origin countries were India (20%), China (15%), and Canada (10%), respectively, and their inventors are tracked separately; all other countries are grouped by geography.¹² Figure 2 highlights the concentrated nature of immigrant inventor-patentee origins: nearly one-half come from the top three countries. Among regional categories, Europe led with 26% of the total, and the United Kingdom (7.8%) is the top source country. The Pacific Rim accounted for 15%, with the Republic of Korea (3.7%) and Japan (3.7%) having nearly-equal contributions. Across the remaining regions of Africa (2%), South/Central America (4%), and Asia/Other (8%), the top countries were South Africa (0.4%), Mexico (1.0%), and Russia (2.1%), respectively.

11. See [Figure LBR-31](#) in Okrent and Burke (2021).

12. Countries are categorized according to the "Area Groupings" used in the U.S. International Trade in Goods and Services report (FT-900), released monthly by the U.S. Census Bureau and the Bureau of Economic Analysis. For details, see press release CB 24-107, BEA 24-30, issued by the U.S. Census Bureau and the Bureau of Economic Analysis, July 3, 2024, at https://www.census.gov/foreign-trade/Press-Release/current_press_release/index.html.

Figure 2: Immigrant inventor-patentees by region of origin, filing years 2000–2012



Source: Author's estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

Interestingly, the most common countries that immigrant inventor-patentees came from are quite different from the origins of the foreign-born population in the United States. In 2010, more than one-half of all foreign-born individuals in the United States were born in Latin America and the Caribbean, followed by 28% from Asia and 12% from Europe.¹³ This suggests that immigrants from Latin American and the Caribbean were under-represented as inventor-patentees, relative to other categories of foreign-born individuals. Notably, foreign-born individuals from Latin America were also the category least likely to hold a bachelor's degree or higher: in 2010, only 11% of those from Latin American held such degrees, compared with 33% to 49% for those born in other parts of the world.¹⁴ These differences in education could, at most, account for only a small portion of the differences in participation rates in the invention ecosystem across regions of origin. Taken together, the findings suggest that there is significant potential for growth in invention and patenting by immigrants from regions of origin that are historically under-represented in the U.S. innovation ecosystem.

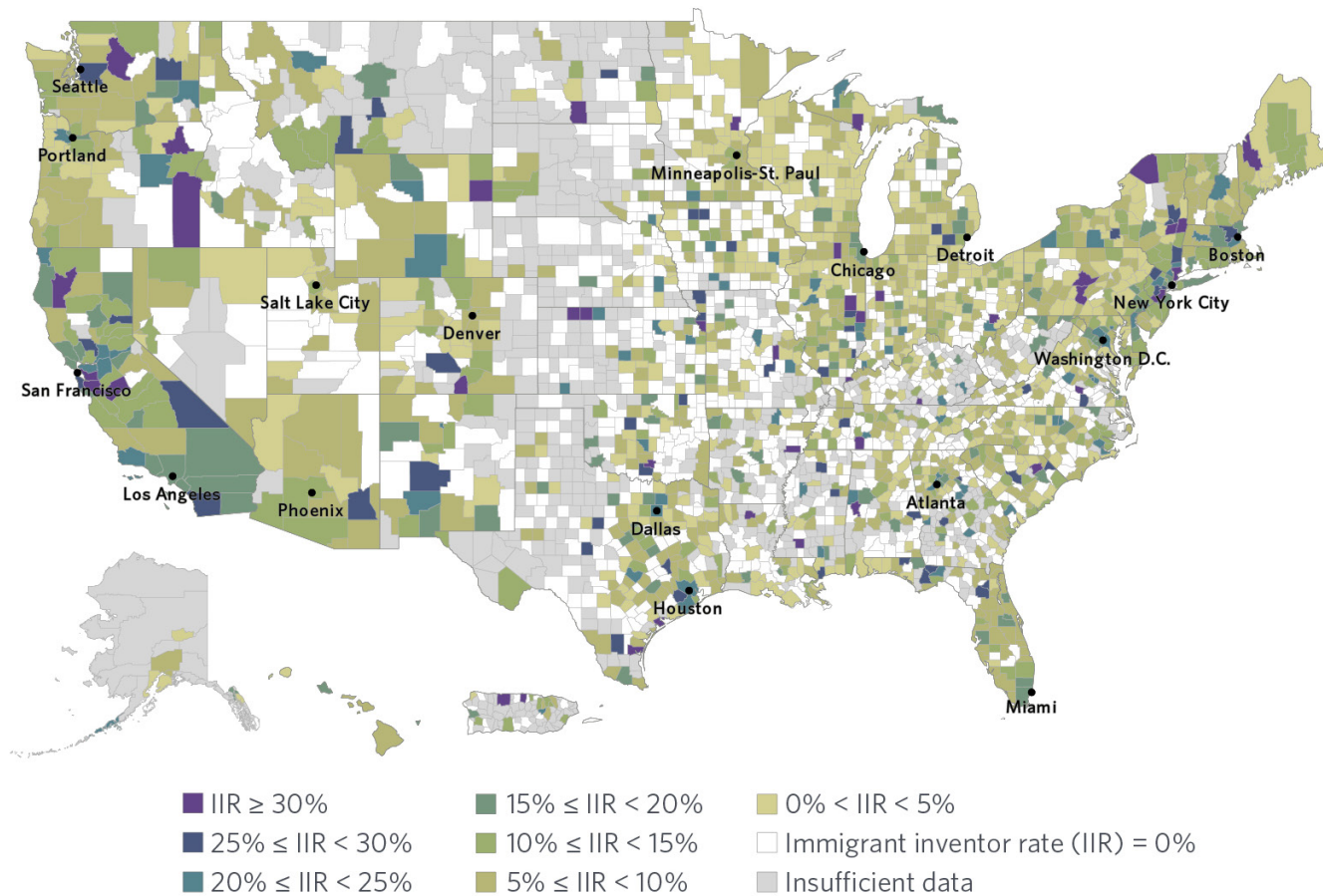
13. See [Table 2](#) in Azari et al. (2024).

14. See [Figure 7](#) in Azari et al. (2024).

Where in the United States are immigrant inventor-patentees located?

Immigrant inventor-patentees are present throughout the United States; however, immigrants were most common among the inventor populations near large cities, the U.S. coastline, and the Great Lakes, and they were under-represented in the interior of the country. This pattern suggests that there is the potential to expand innovation in the regions where immigrant inventor-patentees are under-represented. Because of high levels of diversity within U.S. states, this report focuses on county-level measures, which tend to offer a more precise perspective.¹⁵ Figure 3 displays IIRs by county across the United States, covering granted patents filed from 2000 through 2012. During that time period, the overall IIR across the United States was approximately 17%, so counties with an IIR in the range of 15% to 20% were in line with the national rate. Counties above this range have a higher share of immigrants within their population of inventor-patentees relative to the country as a whole. This group includes Santa Clara County, California (IIR = 39%), which covers Silicon Valley and Stanford University, and was the county with the highest numbers of both patents and unique inventors during filing years 2000-2012. However,

Figure 3: Immigrant inventor rates by county, filing years 2000-2012



Source: Author's estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

15. See Saksena, Rada, and Cook (2022).

counties with smaller numbers of patents and inventors were also present near the top of the IIR rankings, including Middlesex County, New Jersey (IIR = 40%), home of Rutgers University; Champaign County, Illinois (IIR = 37%), home of the University of Illinois; and Tippecanoe County, Indiana (IIR = 32%), home of Purdue University. The geographic pattern of immigrant inventor rates is notably different from the state-level foreign born population shares identified in the 2010 American Community Survey. For example, the states of Washington (IIR = 25%) and Delaware (IIR = 22%) exhibited immigrant inventor rates that are significantly higher than their shares of foreign-born individuals (13.1% and 8.0%, respectively).¹⁶

There was a positive correlation between county-level immigrant inventor rates and total patent output, especially among counties that generated five or more patents per year. This means that counties with lower-than-average immigrant inventor rates tended to produce few patents. Exceptions to this pattern had immigrant inventor rates only slightly below the national rate, including the counties containing Cincinnati, Ohio (Hamilton County, IIR = 10%), Rochester, New York (Monroe County, IIR = 12%), Minneapolis, Minnesota (Hennepin County, IIR = 12%), and Detroit, Michigan (Wayne County, IIR = 13%). The combination of high patenting and below-average rates of immigrant inventor-patentees suggests the potential for expanding invention and patenting if more immigrants were to join the innovation ecosystems in these regions.

What kinds of inventor teams do immigrants join?

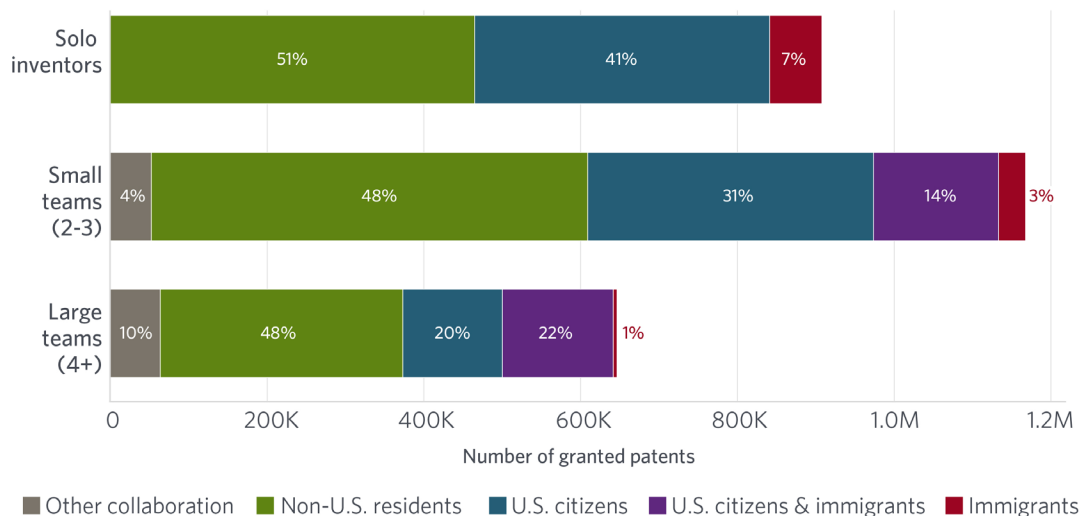
The vast majority of patents with one or more immigrant inventor-patentees were collaborations with U.S. citizen inventors. This is consistent with earlier studies of inventor teams, which find that scientific and technological production is increasingly characterized by collaboration among inventors.¹⁷ Figure 4 illustrates the relationship between immigrant inventor-patentees and the types of collaborations present in granted U.S. patents with filing years from 2000 through 2012. The figure's top bar tracks single-inventor patents: 51% of these were invented by non-U.S. residents, 41% by U.S. citizen-residents, and only 7% by immigrants residing in the United States.¹⁸

16. See [Table A.1](#) in the Appendix for state-level immigrant inventor rates and percentages of foreign-born individuals.

17. See Jones, Wuchty, and Uzzi (2008) and Wuchty, Jones, and Uzzi (2007).

18. Note that many immigrant inventor-patentees eventually obtain U.S. citizenship. For the purposes of illustration, all results in this report classify inventor-patentees on the basis of the citizenship listed in their first-filed patent, regardless of later changes to their citizenship status.

Figure 4: Inventor team collaboration categories, filing years 2000–2012



Source: Author's estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

The second bar focuses on patents with two or three inventors,¹⁹ and displays an increasing contribution by immigrants: a total of 17% of these patents had at least one immigrant inventor-patentee, and the vast majority of these (more than 80%) were the result of collaborations with U.S. citizens. Interestingly, collaborations between immigrants and non-U.S. residents were quite rare, representing only 1% of patents with two or three inventors. This suggests that immigrant inventor-patentees tended to integrate into the domestic innovation ecosystem, rather than patenting with foreign inventors.

The bottom bar in Figure 4 tracks patents with four or more inventors, and continues the pattern of increasing contributions by immigrants. Among these large-inventor-team patents, 22% were the result of collaborations between U.S. citizens and immigrants. These collaborations generated more patents than large teams of all-U.S.-citizen inventors, highlighting the importance of immigrant inventor-patentees to the most collaborative category of U.S. patenting.

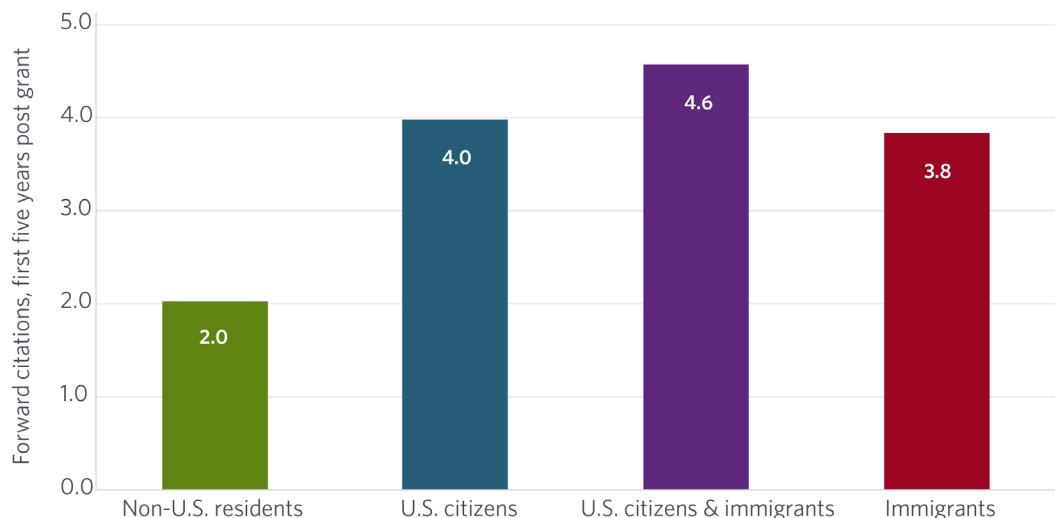
How influential are immigrants' patents?

Patents receive citations from subsequent patents (i.e., “forward citations”) when they influence the development of future inventions and technologies. Higher rates of forward citations are correlated with greater patent value.²⁰ Figure 5 uses forward citations to track the average impact of granted patents based on the composition of their inventor teams.

19. The “Other Collaborations” category includes collaborations between non-residents and U.S. citizens, non-residents and immigrants, and fully-mixed teams containing non-residents, U.S. citizens, and immigrants.

20. See Hall, Jaffe, and Trajtenberg (2005) and Higham, Rassenfossé, and Jaffe (2021).

Figure 5: Immigrants and average patent impact, filing years 2000–2012



Source: Author's estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

Specifically, the figure tracks forward citations received by patents in the first five years after being granted (i.e., their “issue dates”). The categories of patents are defined in the same way as those in Figure 4.²¹

The greatest impact came from inventor teams that are composed of a combination of U.S. citizens and immigrants: these patents generated an average of 4.6 forward citations, or 15% more than the patents of inventor teams made up of only U.S. citizens. A similar pattern was present for patent maintenance: collaborations between U.S. citizens and immigrants had the highest maintenance fee payment rates across all time horizons.²² These findings suggest that inventor collaborations between U.S. citizens and immigrants generate patents with high value to both the U.S. innovation ecosystem and the U.S. economy.

Notably, the patents of non-U.S. residents generated far fewer citations on average than other categories of inventor teams. The comparison between non-U.S. residents and immigrants is particularly important. Both groups of inventors were initially outside the United States, but non-U.S. residents remained there while immigrant inventor-patentees left their country of origin and joined the U.S. innovation ecosystem. The difference in patent impact between these groups indicates that immigrant inventor-patentees were significantly above-average compared with other inventors from their countries of origin.

21. The “other collaboration” category is not included in Figure 5 because it covers categories of inventor teams with very different levels of average patent impact.

22. Specifically, patents resulting from collaborations between U.S. citizens and immigrants had maintenance fee payment rates of 90% at four years, 73% at eight years, and 52% at 12 years. See Figure A.1 in the Appendix for more details on the maintenance rates of other collaboration categories.

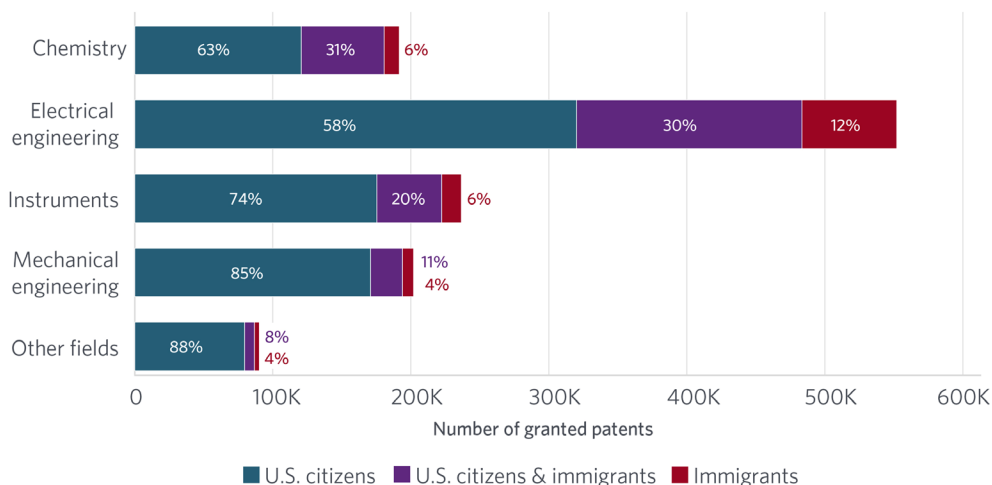
In which technologies do immigrants patent?

Across all technologies, 24% of domestic patents²³ resulted from collaborations between U.S. citizens and immigrants, and an additional 8% were generated by all-immigrant inventor teams. However, there were large differences across technologies: immigrant inventor-patentees were over-represented in electrical engineering patents, and under-represented in mechanical engineering. Figure 6 presents the contribution of immigrant inventor-patentees to U.S. patenting across broad technology sectors.²⁴ For each sector, the figure tracks the total number of granted patents filed by U.S.-based inventors from 2000 through 2012, and the percentages contributed by inventor teams made up of all U.S. citizens, collaborations between citizens and immigrants, and all-immigrant inventor teams.

Immigrant inventors contributed to relatively few patents in mechanical engineering, where collaborations and all-immigrant patents accounted for just 11% and 4% of patenting, respectively. Mechanical engineering includes “engines, pumps, [and] turbines,” “textile and paper machines,” and “transport,” suggesting that this sector covers many well-established technologies.

At the other extreme, immigrant inventors provided the largest contributions to U.S. invention in electrical engineering, where collaborations and all-immigrant patents accounted for 30% and 12% of patenting, respectively. This technology sector includes “telecommunications”, “computer technology”, and “semiconductors,” which have been the focus of significant policy discussion in recent years. In particular, the semiconductor industry was the target of the CHIPS and Science Act of 2022, highlighting the importance of this field and the electrical engineering technology sector as a whole to U.S. interests in terms of national security, innovation, and economic growth.

Figure 6: Immigrant contributions to U.S. patenting by technology sector, filing years 2000–2012



Source: Author’s estimates using USPTO inventor oaths and declarations, and PatentsView data (<https://patentsview.org/>)

23. For the purposes of this analysis, a domestic patent is one in which all inventors list a residence (city, state) located in the United States.

24. Utility patents are grouped into the “WIPO technology categories” suggested by Schmoch (2008) based on their first-listed International Patent Classification. The WIPO categories reflect five technology sectors, which can be further subdivided into 35 technology fields.

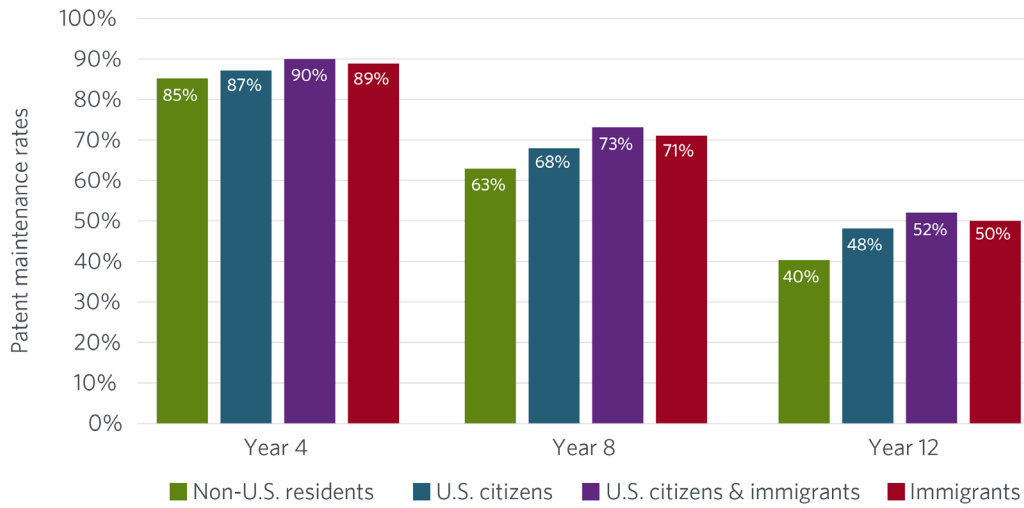
Conclusions

This report is the first to take advantage of the inventor citizenship data collected by the USPTO from all inventors who filed patent applications before the implementation of the America Invents Act. Its findings on the contributions of immigrant inventor-patentees inform the policy debates on immigration and on innovation. Specifically, the report finds that immigrant inventor-patentees contributed to a growing share of U.S. patenting, and that their contributions were concentrated in high-impact patent and strategically important technology fields. Importantly, the greatest benefits of immigrant invention emerged through collaborations with U.S. citizens, generating greater impact and value than either group working on its own.

This report also highlights several dimensions in which there is the potential to expand the contribution of immigrant inventor-patentees. Counties in the U.S. interior tended to have relatively low immigrant inventor rates compared with counties near the U.S. coastline and the Great Lakes, suggesting the opportunity to bring larger numbers of immigrants into the innovation ecosystem. Similarly, technology fields including textiles, paper, and transportation exhibited relatively low rates of contributions from immigrant inventor-patentees, compared with the large contributions seen in electrical engineering. Overall, this report provides a foundation for understanding the contribution of immigrants to U.S. invention, and identifies important pathways for expanding their participation for the benefit of all U.S. residents.

Appendix

Figure A.1: Patent maintenance rates by collaboration category, filing years 2000–2012



Source: Author's estimates using USPTO inventor oaths and declarations, patent maintenance fee records

Table A.1: State-level immigrant inventor rates (filing years 2000–2012) and foreign-born population rates (2010)

State	Immigrant inventor rate (%)	Foreign-born rate (%)	Difference
Alabama	9.9	3.5	6.4
Alaska	6.5	6.9	-0.4
Arizona	13.4	13.4	0.0
Arkansas	10.0	4.5	5.5
California	27.6	27.2	0.4
Colorado	9.7	9.8	-0.1
Connecticut	13.6	13.6	0.0
Delaware	22.4	8.0	14.4
District of Columbia	13.9	13.5	0.4
Florida	12.5	19.4	-6.9
Georgia	14.9	9.7	5.2
Hawaii	13.9	18.2	-4.3
Idaho	12.0	5.5	6.5
Illinois	15.4	13.7	1.7
Indiana	12.0	4.6	7.4
Iowa	9.2	4.6	4.6
Kansas	10.8	6.5	4.3
Kentucky	10.2	3.2	7.0
Louisiana	8.4	3.8	4.6

State	Immigrant inventor rate (%)	Foreign-born rate (%)	Difference
Maine	9.2	3.4	5.8
Maryland	16.8	13.9	2.9
Massachusetts	21.7	15.0	6.7
Michigan	13.3	6.0	7.3
Minnesota	8.8	7.1	1.7
Mississippi	9.5	2.1	7.4
Missouri	11.5	3.9	7.6
Montana	8.2	2.0	6.2
Nebraska	10.4	6.1	4.3
Nevada	9.0	18.8	-9.8
New Hampshire	11.1	5.3	5.8
New Jersey	23.8	21.0	2.8
New Mexico	11.9	9.9	2.0
New York	20.1	22.2	-2.1
North Carolina	14.0	7.5	6.5
North Dakota	10.4	2.5	7.9
Ohio	9.9	4.1	5.8
Oklahoma	9.0	5.5	3.5
Oregon	16.7	9.8	6.9
Pennsylvania	14.0	5.8	8.2
Rhode Island	10.4	12.8	-2.4
South Carolina	12.6	4.7	7.9
South Dakota	5.5	2.7	2.8
Tennessee	10.0	4.5	5.5
Texas	18.3	16.4	1.9
Utah	8.3	8.0	0.3
Vermont	10.6	4.4	6.2
Virginia	13.4	11.4	2.0
Washington	24.7	13.1	11.6
West Virginia	7.5	1.2	6.3
Wisconsin	9.2	4.5	4.7
Wyoming	6.5	2.8	3.7
U.S. total	17.1	12.9	4.2

Source: Author's estimates using inventor oaths and declarations in combination with PatentsView data (<https://patentsview.org/>), and foreign-born population rates from Azari et al. (2024)

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