Talent Recruitment Roulette: Replacing the H-1B Lottery

By Jeremy Neufeld
January 2024

Executive summary

Employers register for hundreds of thousands of H-1Bs each year, competing for just 85,000 visas. But USCIS awards scarce visas by lottery, rather than to the most valuable workers.

Random selection has created severely perverse incentives:

a. It favors outsourcing companies that specialize in lower-paying jobs in less-specialized occupations, such as IT services.

b. It discourages employers from identifying and recruiting particularly talented candidates, because there is no certainty they can successfully get a visa for a given person.

c. It encourages employers to seek H-1Bs for many more workers than there are available visas, costing over $1.9 billion in wasted recruitment efforts a year.

Using new data on approved H-1B petitions obtained from USCIS by a Freedom of Information Act request, I simulate the results of alternatives to the current H-1B lottery: seniority-based ranking, compensation-based ranking, and the allocation mechanism from Section 104 of the bipartisan H-1B and L-1 Visa Reform Act. Any of them would be an improvement over the status quo, significantly increasing the average compensation offered to H-1Bs.

Key takeaways

- Without changing the number of visas, replacing the lottery could increase the economic value of the program to the United States by 88%, equivalent to the effect on GDP of raising the cap by 75,000.
- **Seniority-based ranking.** In President Trump's first administration, the Department of Homeland Security proposed ending random selection and replacing it with a ranking based on seniority (i.e., wage levels within an occupation and area). This system would have increased the total economic value of the H-1B program by 48% over ten years. However, the system would have put early-career workers, including recent international students, at a disadvantage.
- **Compensation-based ranking.** Adopting a pure compensation-based ranking would have increased the economic value of the program by 88% over ten years, without putting students at a disadvantage and reducing the number of visas issued to outsourcing companies.
- **Allocation from Section 104 of the H-1B and L-1 Visa Reform Act.** The bipartisan H–1B and L–1 Visa Reform Act of 2023 includes a proposed allocation of H-1B visas that would prioritize education and graduates from American universities. It would have increased the economic value of the H-1B program by 35% over ten years and transformed the H-1B into a visa exclusively for STEM graduates of US universities.
- I recommend a compensation-based system that is adjusted by:
  - **a.** Regional price-parity, to account for cost-of-living differences across geographies
  - **b.** Age, to account for the expected lifetime contribution of beneficiaries

Contents

Introduction

USCIS does not currently ensure that scarce H-1B visas — the country's flagship high-skilled migration program — are actually awarded to the most skilled, productive, and valuable talent.

The H-1B program lets employers sponsor workers who have specialized knowledge and at least a college degree. While universities, affiliated organizations, and non-profit research institutions may sponsor as many workers as they would like, most employers are subject to a strict cap that limits the number of H-1B visas issued each year to 85,000. Since 2014, employers have sought far more H-1Bs for open positions than the 85,000 visas that are available.

H-1Bs were originally awarded on a first-come, first-served basis. Once USCIS began to receive greater demand for visas than available slots, it had to improvise a new system. Since 2005, USCIS has relied on at least some randomization in allocating H-1B visas. After some variations, it arrived at the random lottery used today.[1]

In spite of all its flaws, the program has helped drive American innovation and productivity growth.[2] Economists have also found that H-1Bs have reduced offshoring of jobs by multinationals to other countries such as Canada, India, and China.[3]

Nevertheless, the program is not living up to its potential. The H-1B program does not bring in the most skilled talent, it puts workers at risk of exploitation, and it subjects American workers to unnecessary competition. Many of these problems are not a function of high-skilled immigration generally; they are specifically caused by the incentives created by awarding visas at random.

This paper investigates how to improve the quality of the H-1B visa program, taking the current number of visas as given. Replacing the random lottery has drawn support from across the political spectrum: it was proposed by growth-minded economists, attempted under the first Trump administration, promised on the campaign trail by Joe Biden, endorsed by the Congressional Progressive Caucus, and introduced in bipartisan legislation in the US Senate. But despite substantial support across the political spectrum for replacing the lottery, little analysis exists comparing different alternatives to one another and to the status quo. This analysis fills that gap.

---

[1] Actually two lotteries. 20,000 are reserved for graduates with advanced degrees from American universities.

[2] William R. Kerr and William F. Lincoln, "The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention," *Journal of Labor Economics* 28, no. 3 (July 2010): 473–508, https://doi.org/10.1086/651934; Jennifer Hunt, "Which Immigrants Are Most Innovative and Entrepreneurial? Distinctions by Entry Visa," Journal of Labor Economics 29, no. 3 (July 2011): 417–57, https://doi.org/10.1086/659409; Anirban Ghosh, Anna Maria Mayda, and Francesc Ortega, "The Impact of Skilled Foreign Workers on Firms: An Investigation of Publicly Traded U.S. Firms," IZA Discussion Papers (Institute of Labor Economics (IZA), November 2014), https://ideas.repec.org/p/iza/izadps/dp8684.html; Giovanni Peri, Kevin Shih, and Chad Sparber, "STEM Workers, H-1B Visas, and Productivity in US Cities," Journal of Labor Economics 33, no. S1 (July 2015): S225–55, https://doi.org/10.1086/679061; Jun Chen, Shenje Hshieh, and Feng Zhang, "The Role of High-Skilled Foreign Labor in Startup Performance: Evidence from Two Natural Experiments," Journal of Financial Economics 142, no. 1 (October 2021): 430–52, https://doi.org/10.1016/j.jfineco.2021.05.042; Stephen G. Dimmock, Jiekun Huang, and Scott J. Weisbenner, "Give Me Your Tired, Your Poor, Your High-Skilled Labor: H-1B Lottery Outcomes and Entrepreneurial Success," Management Science 68, no. 9 (September 2022): 6950–70, https://doi.org/10.1287/mnsc.2021.4152; and Giovanni Peri, Kevin Shih, and Chad Sparber, "STEM Workers, H-1B Visas, and Productivity in US Cities," Journal of Labor Economics 33, no. S1 (July 2015): S225–55, https://doi.org/10.1086/679061.

[3] Britta Glennon, "How Do Restrictions on High-Skilled Immigration Affect Offshoring? Evidence from the H-1B Program," *Management Science* 70, no. 2 (February 2024): 907–30, https://doi.org/10.1287/mnsc.2023.4715.

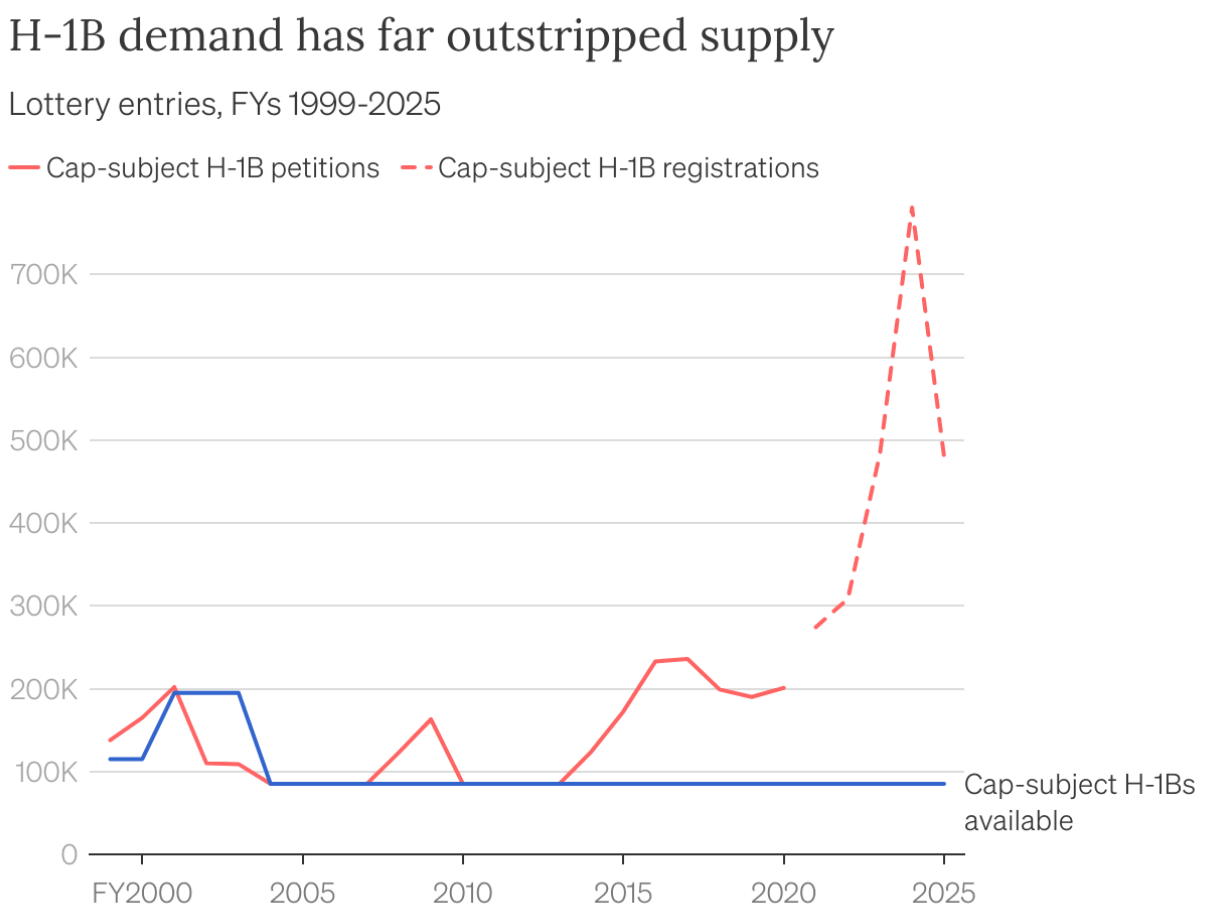
Section I examines the effects of the H-1B status quo. Section II describes different alternatives to the current lottery that have been proposed. Section III quantitatively and qualitatively compares and contrasts a number of these alternatives, looking at how each selection method would affect various economic outcomes, the distribution of visas, and the effects on H-1B outsourcing. The comparison relies on simulating H-1B distribution under alternative proposals using novel microdata on H-1B petitions obtained from USCIS via a Freedom of Information Act (FOIA) request. This section also assesses the major advantages and disadvantages of each selection method. Section IV concludes with some closing thoughts. The Appendix includes a more technical description of the simulation methods and modelling used in this analysis.

I. The underwhelming status quo

In April 2024, USCIS received 470,342 eligible registrations for cap-subject H-1Bs. With only 85,000 visas available, more than four in five registrations will not yield a visa. But USCIS does not allocate these scarce visas to the most valuable talent. Instead, since FY 2008, USCIS has handed out visas at random when demand has exceeded the supply, which it has consistently since FY 2014.

In 2004, Congress added 20,000 visas reserved for master's graduates from US universities to the existing pot of 65,000 visas. But apart from this second lottery, USCIS does not prioritize between registrants. The Trump administration issued a rule changing the lottery order to slightly increase the odds of advanced graduates from US universities. The Biden administration has passed a rule to select on individual beneficiaries not employers. But despite both of these changes, random chance remains at the heart of selecting H-1Bs. World-class experts have the same likelihood of being selected as entry-level IT workers.

The result is that the H-1B program has fallen significantly short of its potential. Many employers seeking the highest-skilled talent are rejected in favor of those registering on behalf of lower-skilled workers. Companies have lost the ability to reliably hire specific workers because registering for an H-1B only gets a lottery ticket. Some companies have specialized in outsourcing for temporary support services, sponsoring hundreds or even thousands of workers who they will contract out to work at other companies. Visas are no longer available throughout the year but only briefly available for a short window before the fiscal year even begins. In addition to the uncertainty, all the time and resources spent on recruiting workers who are never selected in the lottery are wasted. Further, although the extent of this problem remains the subject of much debate, the lottery has increased the chances that native employment and wages are undercut by H-1B workers.



From FYs 1999-2020, employers filed full petitions to be drawn in the lottery. Starting in FY2020, USCIS used the electronic registration process to conduct the lottery.

Chart: Jeremy Neufeld • Source: USCIS

The figure above shows the increase in the demand for H-1Bs over time, measured by H-1B petitions before the onset of the electronic registration system in 2020 and by registrations afterward. The demand for new H-1B workers has drastically exceeded the number of visas available, which has long remained stagnant. However, registrations understate the latent demand for H-1Bs. The costs of recruiting international workers and the massive uncertainty and unreliability posed by random selection mean that many employers who would benefit from an H-1B if they could secure one never even try.

Furthermore, random selection gives no more weight to registrations for higher-paying jobs than lower-paying ones, making competition with other workers more likely. High-profile cases of workers training their own replacements may not be the norm, but they are made possible by the current design of the program, and generally followed the use of random selection to allocate H-1Bs. Foreign workers with more common skills are more likely to represent competition with native-born workers. Despite evidence that the H-1B program has had positive effects on innovation, the evidence on labor market competition has been much more mixed.[4] A

[4] Lauren Gilbert offers a useful review of the literature at "H-1B Visas and the American Economy," *Lauren Policy* (January 2025), https://substack.com/home/post/p-154775445.

significant wage premium for H-1B workers indicates that, at least on average, H-1B workers are paid better than comparable natives. However, that premium has fallen since the random lottery went into effect.[5] Complicating this picture is other evidence suggesting a greater degree of competition. Some studies have found that employment and earnings for natives in the computer occupations would have been higher without the H-1B system,[6] that H-1B workers crowded out natives,[7] and that there's little to no wage premium when not controlling for skills.[8] And while immigrants are net job creators, visa restrictions make it more difficult for H-1B beneficiaries to found companies than when they earn green cards.[9]

Of course, labor market outcomes for native computer workers are not necessarily the primary effect that policymakers are interested in. More important than the program's effect on labor markets is the fact that H-1B workers contribute to innovation.[10] The major benefit to Americans from the H-1B program is not increased labor supply or increased labor demand, but increased productivity and productivity growth. H-1B workers bring valuable ideas, talents, and perspectives. They make breakthroughs and advances directly. And, by working alongside Americans, the resulting combination of perspectives can be greater than the sum of its parts, generating new ideas that neither American nor foreigner would have found on their own. But not all H-1B beneficiaries are equally likely to innovate. Yet the current allocation of visas does not favor occupations or industries that are likely to contribute to productivity growth or otherwise generate broad-based benefits for the entire population.

If we want to maximize the productive potential of the country's major high-skilled immigration program, replacing the lottery would both directly increase the economic value from the visas we do issue, and help combat the abuse of the program, which drives skepticism that the H-1B program is serving the interests of the United States.

Since individual employers can no longer depend on being able to identify and sponsor particular workers, it has become increasingly common for the H-1B program to be used by companies which specialize in securing H-1B visas. A natural market response to the emergence of the H-1B lottery, H-1B-dependent employers employ H-1B workers as a significant fraction of their workforce. H-1B-dependent firms are those that employ at least 8 H-1B employees if they have under 26 total employees, at least 13 H-1B employees if they have 26-50 employees, or at least 15% of all employees if they have more than 50 employees.[11] From FYs 2017-2022, an

---

[5] Omid Bagheri, "Are College Graduate Immigrants on Work Visas Cheaper than Natives," *CGO Working Paper* (March 2021), https://www.thecgo.org/research/are-college-graduate-immigrants-on-work-visas-cheaper-than-natives/.

[6] John Bound et al., "Recruitment of Foreigners in the Market for Computer Scientists in the United States," *Journal of Labor Economics* 33, no. S1 (July 2015): S187–223, https://doi.org/10.1086/679020.

[7] Kirk Doran, Alexander Gelber, and Adam Isen, "The Effects of High-Skilled Immigration Policy on Firms: Evidence from Visa Lotteries," *Journal of Political Economy* 130, no. 10 (October 1, 2022): 2501–33, https://doi.org/10.1086/720467.

[8] Bagheri, "Are College Graduate Immigrants on Work Visas Cheaper than Natives."

[9] Pierre Azoulay et al., "Immigration and Entrepreneurship in the United States," *American Economic Review: Insights* 4, no. 1 (March 1, 2022): 71–88, https://doi.org/10.1257/aeri.20200588.

[10] Kerr and Lincoln, "The Supply Side of Innovation;" Hunt, "Which Immigrants Are Most Innovative"; Ghosh, Mayda, and Ortega, "The Impact of Skilled Foreign Workers"; Peri, Shih, and Sparber, "STEM Workers, H-1B Visas, and Productivity"; Chen, Hshieh, and Zhang, "The Role of High-Skilled Foreign Labor in Startup Performance;" Dimmock, Huang, and Weisbenner, "Give Me Your Tired, Your Poor, Your High-Skilled Labor;" and Peri, Shih, and Sparber, "STEM Workers, H-1B Visas, and Productivity in US Cities."

[11] Department of Labor, Wage and Hour Division, "Who is an H-1B-dependent employer?" (2008), https://www.dol.gov/agencies/whd/fact-sheets/62c-h1b-dependent-employer

average of 29% of approved I-129 petitions for new employment, cap-subject H-1B petitions went to H-1B-dependent firms each year.[12]

Even more reliant on H-1B visas are companies with over 50 employees with over half of their workforce comprising H-1Bs, L-1As, or L-1Bs. These so-called "fee-paying" companies (because they are subject to additional fees) secured 10% of approved I-129 petitions for new employment, cap-subject H-1Bs in FYs 2017-2022.[13]

Many H-1B-dependent employers are outsourcing companies, which became increasingly profitable after the lottery system went into effect.[14] The rise of H-1B outsourcing was facilitated by the lottery reducing the ability for firms to reliably hire particular individuals. Since the introduction of the random lottery, new cap-subject H-1Bs have been gobbled up by a smaller number of firms, a trend that is not mirrored among cap exempt H-1Bs which do not face a lottery.[15] Before the random lottery, most H-1Bs went to firms hiring fewer than six H-1B workers, but after it went into effect, the share plummeted.[16] By the same token, the share of new H-1Bs going to employers with more than 250 H-1Bs has grown by multiple times.[17]

Outsourcing companies register for large numbers of H-1Bs, which means they are likely to secure at least some number of visas for workers who they can then contract out to employers who need temporary services like IT. This model is unlikely to result in high-value matches in which highly-skilled and innovative workers are bringing irreplaceable skills to unique niches. Instead, H-1B-dependent staffing companies operate their business knowing that if they submit many registrations, they are likely to get some of them approved. They generally are trying to have a reserve of more-or-less replaceable workers who they can contract out to third parties rather than identify uniquely talented people who are suited for a particular niche. H-1B-dependent employers tend to offer lower wages. Among I-129s approved for new employment, cap-subject H-1Bs from 2017-2022, the average salary promised by H-1B-dependent employers was $92,000, more than the $83,000 offered by fee-paying employers (that is, employers of at least 50 workers, of whom 50% or more are on H-1Bs or L visas), but less than the $102,000 offered by other employers.[18]

[12] Author's calculation.

[13] Author's calculation.

[14] Rishi R. Sharma and Chad Sparber, "Buying Lottery Tickets for Foreign Workers: Lost Quota Rents Induced by H-1B Policy," *Journal of International Economics* 150 (July 2024): 103932, https://doi.org/10.1016/j.jinteco.2024.103932.

[15] Ibid.

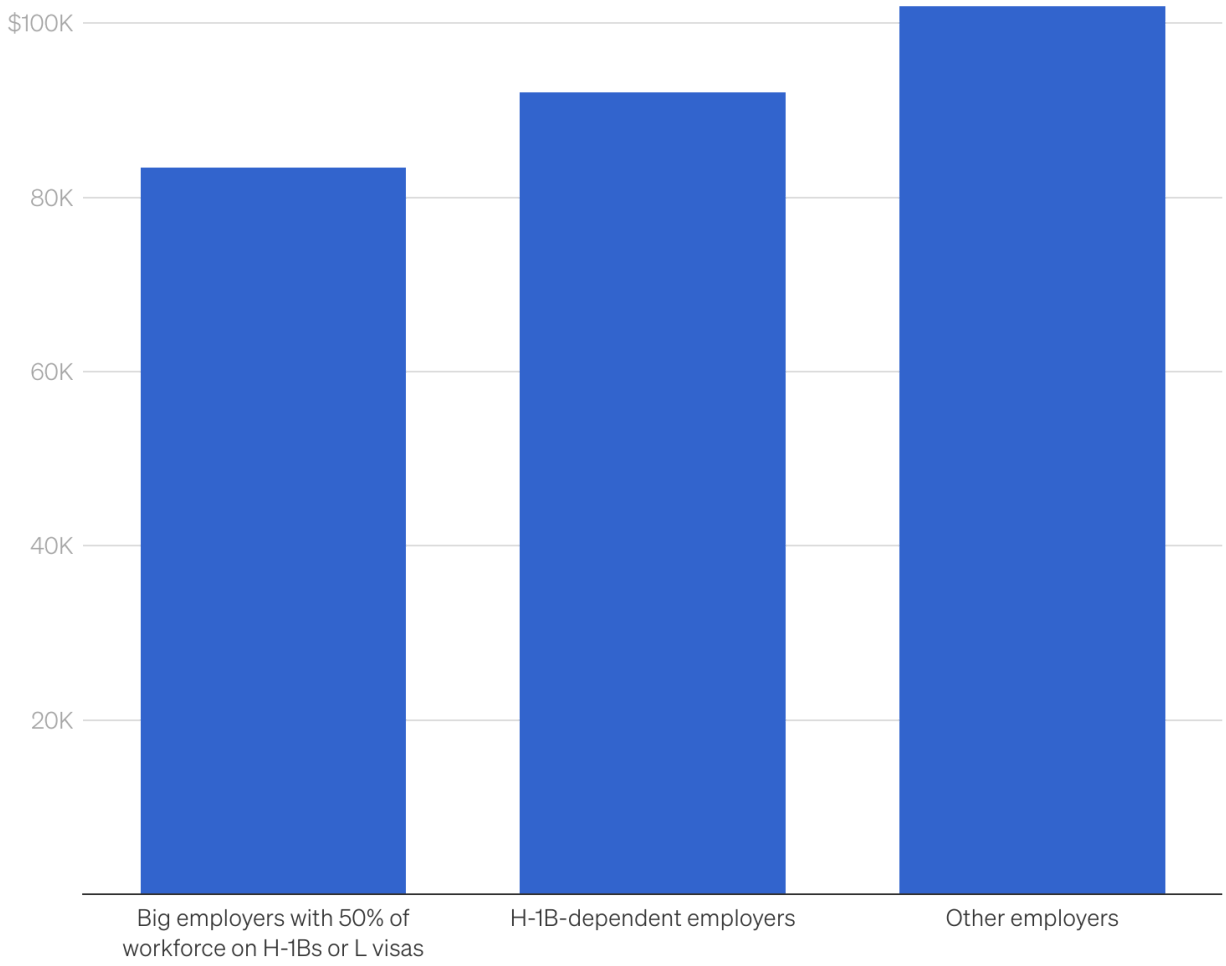
[16] Ibid.

[17] Ibid.

[18] Author's calculation.

Staffing companies take visa slots but pay less

Mean salary offered by employers among approved initial I-129 petitions, FY2017-2022



Fee-paying employers are those with 50 or more employees in the United States and with more than 50 percent of its employees in H-1B or L visas. H-1B-dependent firms are those that employ at least 8 H-1B employees if they have under 26 total employees, at least 13 H-1B employees if they have 26-50 employees, or if they have more than 50 employees of whom at least 15 percent are on H-1Bs.

Chart: Jeremy Neufeld • Source: USCIS I-129 microdata, obtained via FOIA

In 2021, half of the top thirty H-1B employers were outsourcing companies.[19] The lottery doesn't put outsourcing companies and other companies on an even playing field — the outsourcing business model is instead given a major advantage. Under a more predictable system, outsourcing companies would have to find ways to compete, perhaps by specializing in spotting and recruiting more talented international workers, or lose out to higher-paying competitors. Random selection encourages a very different strategy: barrage the H-1B system with as many minimally qualified workers as possible.

[19] Ron Hira and Daniel Costa, "The Biden administration can stop H-1B visas from fueling outsourcing," Economic Policy Institute (March 2022), https://www.epi.org/blog/the-biden-administration-can-stop-h-1b-visas-from-fueling-outsourcing-half-of-the-top-30-h-1b-employers-were-outsourcing-firms-in-2021/.

II. Beyond random selection

Antagonism toward random selection has united a strange coalition in American immigration politics. Pro-immigration economists have criticized it for being inefficient and reducing the skills composition of visa recipients.[20] It has been criticized by both the pro-labor left and right for undercutting natives. In Congress, it has brought together partners from across the aisle in opposition. And replacing it formed part of the immigration agendas of both Presidents Trump and Biden.

Nevertheless, there are many different proposals for what exactly should replace the current lottery system.

Below, I discuss the options that have been proposed. Then, I compare the different proposals along a number of dimensions: How would they affect average earnings of H-1Bs? How would they affect US GDP? How do they affect US retention of international students from US universities? How would they affect H-1B-dependent and staffing firms?

While all of the potential replacements would likely be improvements relative to a random lottery, they are not all created equal. Below are three major alternatives:

1. **Seniority-based (wage level) ranking.** The selection rule proposed by DHS in 2020 would have awarded visas to workers with the most seniority (i.e., those furthest along in their careers).[21] While often described as a wage-based selection, this is misleading, because wages would be used to rank petitions within occupations and geographical regions, but not across occupations and locations. As designed, USCIS would first order registrations into four tiers, representing each of the four Department of Labor wage levels, which range from Level 4 ("fully competent") to Level 1 ("entry level"). These levels are intended by DOL to correspond with the level of seniority a worker has. Then USCIS would award visas to the registrants with the highest wage levels, using a lottery for the lowest wage level for which there are still available visas. Since the wage levels correspond to seniority, or at least a worker's standing relative to other workers within their occupation, awarding H-1Bs by wage level puts entry-level and early career workers at a disadvantage. USCIS predicted that no visas would go to entry-level Level 1 workers.

2. **Compensation-based ranking.** A pure compensation-based ranking would simply assign visas from highest to lowest actual compensation. This proposal has been favored by a number of economists including William Kerr for its efficiency and simplicity. A compensation-based ranking leads to significantly different results than the 2020 proposal because it compares compensation across occupations. For example, physicians and engineering managers are high-paying occupations, where even early-career workers making Level 1 wages for their occupation make more than the median wage at Level 3 across all occupations.[22] Under seniority-based ranking, their high pay in the US labor market is given no weight, and only their relative ranking compared to other physicians or engineering managers is considered. Compensation may be adjusted before ranking to account for geography or workers' likely time in the

[20] Giovanni Peri, "Rationalizing U.S. Immigration Policy: Reforms for Simplicity, Fairness, and Economic Growth," Hamilton Project Discussion Paper (May 2012). https://www.hamiltonproject.org/assets/legacy/files/downloads_and_links/05_peri_discussion.pdf

[21] Modification of Registration Requirement for Petitioners Seeking To File Cap-Subject H-1B Petitions, 86 Fed. Reg. 1676 (January 8, 2021), https://www.govinfo.gov/content/pkg/FR-2021-01-08/pdf/2021-00183.pdf.

[22] "The Impact on International Students of Ending the H-1B Lottery," National Foundation for American Policy, Policy Brief (May 2021). https://nfap.com/wp-content/uploads/2021/05/The-Impact-on-International-Students-of-Ending-the-H-1B-Lottery.NFAP-Policy-Brief.May-2021.pdf

workforce. For example, using regional price parity adjusted compensation would allow for better comparisons for employers based in lower cost-of-living areas. Adjusting for age can allow for comparing the full future stream of a worker's contribution, rather than only their contribution in the first year. These adjustments would tend to favor lower cost-of-living states.

3. **Points-based or preference systems.** A points-based or preference system would assign visas in some other objective order determined by policymakers. There's no one way such a system could be implemented, and its flexibility to policymakers is one of its major benefits; it can be tailored and adjusted to address concerns as they arise.

One example of a preference system comes from Section 104 of the bipartisan H-1B Reform Act,[23] which would allocate H-1Bs in the following order:

1. Advanced STEM graduates of American universities
2. Those with wages above the median wage for Level 4
3. Other advanced degree holders from US universities
4. Those with wages above the median wage for skill level three
5. Bachelor's STEM graduates from American universities
6. Other bachelor's graduates from American universities
7. Group 1 Schedule A occupations (i.e., shortage occupations)
8. Employers who use E-Verify and meet other requirements
9. Others.

Visas would be awarded to as many people in category 1 as possible, and if there are any remaining, they would all be made available to category 2, and so on until all visas have been used.

III. Comparing the alternatives

To compare these alternatives, I simulate what the allocation of new H-1Bs would have looked like under each system for FYs 2018-2023, using microdata obtained from USCIS on approximately 513,000 approved I-129 petitions for new employment cap-subject H-1Bs.[24]

These data are preferable to publicly available LCA data since they represent actual approved petitions for H-1Bs. Because LCAs are required to be filed before an employer can petition for an H-1B, employers often file LCAs for H-1B positions to preserve option value and then never go on to seek an H-1B. Many more LCAs get submitted than do eventual H-1B registrations or petitions, so LCAs may not be representative of the actual talent pool. Furthermore, the actual compensation for H-1B workers may be higher than reported in the LCA, which requires reporting a minimum, not the actual compensation in a job offer.

In this section, I first summarize what my simulations reveal about the effects of replacing random selection with the seniority-based ranking proposed by the Trump administration, the wage-based ranking proposed by some economists, and points-based rankings. The main results can be seen in the table below.

[23] H-1B and L-1 Visa Reform Act of 2023, S. 979, 118th Cong. (2023) https://www.congress.gov/bill/118th-congress/senate-bill/979

[24] USCIS provided petitions filed in FYs 2017-2022, which correspond to H-1Bs awarded for FYs 2018-2023.

A more detailed discussion of the methodology behind these simulations and the various outcomes of interest can be found in the appendix.

Comparing lottery alternatives, a summary

	Random selection	Seniority-based (wage level) ranking	Compensation-based ranking	Section 104 of the H-1B Reform Act
Average compensation, new H-1Bs (2018-2023 average)	$97k	$128k (+31%)	$137k (+41%)	$97k (-0%)
Median compensation, new H-1Bs (2018-2023 average)	$88k	$120k (+37%)	$127k (+44%)	$90k (+2%)
Efficiency (expected yearly contribution to GDP, 2026-2035)	$129 billion	$190 billion (+48%)	$243 billion (+88%)	$143 billion (+11%)
H-1Bs to H-1B-dependent employers (2018-2023)	25,000	15,000 (-41%)	13,000 (-49%)	19,000 (-25%)
H-1Bs to fee-paying companies (2018-2023)	8,000	3,000 (-66%)	2,000 (-79%)	3,000 (-59%)
H-1Bs to F-1 students or others already in US on another visa (2018-2023)	54,000	54,000 (+1%)	55,000 (+3%)	84,000 (+56%)
H-1Bs to advanced degree holders (2018-2023)	55,000	57,000 (+3%)	58,000 (+5%)	84,000 (+52%)
H-1Bs to doctorates (2018-2023)	5,000	9,000 (+90%)	9,000 (+97%)	8,000 (+67%)

Table: Jeremy Neufeld

The most important effect of replacing the lottery is that doing so will increase the compensation and skill level of new H-1B workers. Under the lottery, I estimate that the yearly mean compensation of each new H-1B cohort from FYs 2018-2023 amounted to $97,000. I estimate that had the Trump administration's seniority-based selection method been in place over the period, the average compensation would have been higher, at $128,000. Had a compensation-based ranking been used, average compensation would have been higher still, at $137,000, 41% higher than under the lottery. Section 104 of the H-1B Reform Act would have led to lower compensation than the lottery from FYs 2018-2022, but higher compensation in FY2023, averaging out to a small reduction of less than 1%. However, given the trend of higher compensation growth among selected beneficiaries under the system, the proposal may moderately increase H-1B compensation relative to the lottery in the coming decade.

The chart below shows how average compensation would have grown over time under the lottery, seniority-based ranking, compensation-based ranking, and Section 104 of the H-1B Reform Act. Notably, the trends in the chart above show that the lottery can yield stagnation while the same underlying pool of talent would show continued or even accelerated growth in average compensation.

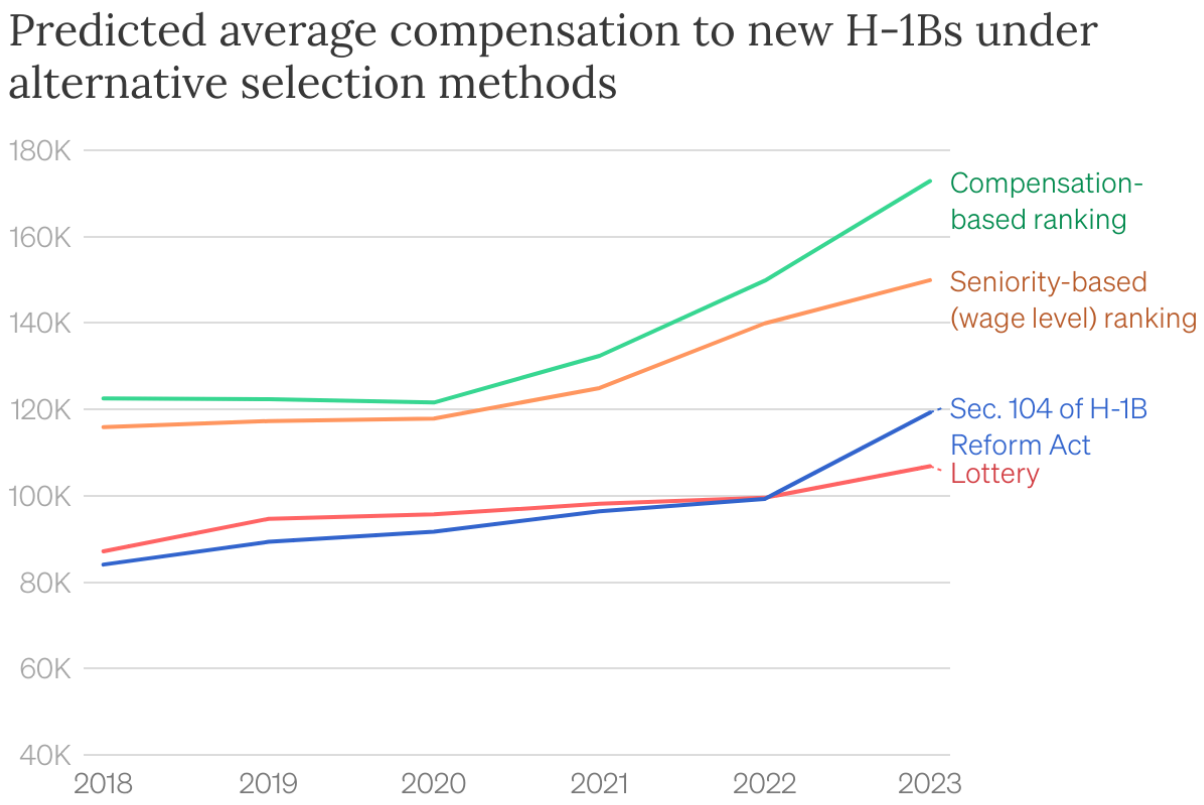


Chart: Jeremy Neufeld

Further, these simple averages conceal important facts about the underlying distribution of compensation among H-1B workers that can be seen in the figure below. While seniority-based and compensation-based rankings increase the median salary by 31% and 41% respectively, they increase compensation at the 25th percentile by 33% and 48% respectively. Compensation at the 75th percentile increases even more, by 37% and 51%. The chart below shows the distribution of compensation under the lottery, a seniority-based ranking, and a compensation-based ranking. The median can be seen in orange, the 25th percentile in red, and the 75th percentile in green.

Who would have been awarded H-1Bs for FY2023 under different selection methods?

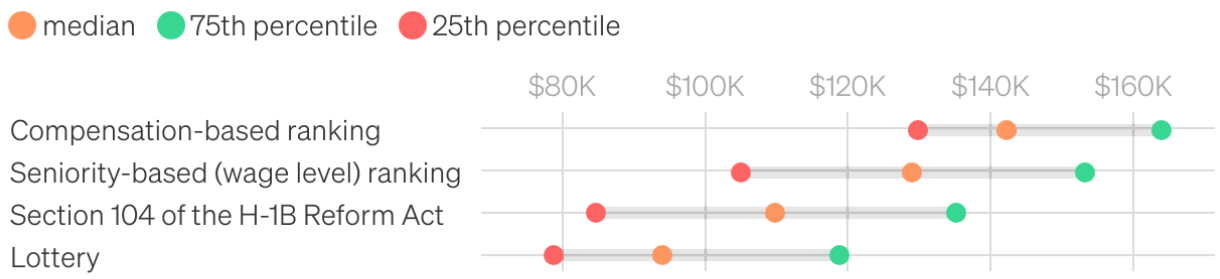


Chart: Jeremy Neufeld

Furthermore, replacing random selection with a predictable system would reduce the costs associated with employers searching for and seeking more workers than are allowed to be hired. Two economists have estimated that these search costs caused by randomly allocating H-1Bs cost the economy over a billion dollars a year over the last five years.[25] If employers were able to better forecast whether their recruitment effort would yield an H-1B, the number of registrations would be much closer to the number of visas actually available, and these costs would be a small fraction of what they are under the uncertainty intrinsic to random selection. Furthermore, since the uncertainty leads to undervaluing of niche, highly specialized candidates, greater certainty would also induce greater investments in finding specialist candidates and improving the pool of talent.

Taken together, these effects — visas allocated to positions commanding higher pay and reduced costs for employers — translate into large aggregate economic gains.

Under the status quo, my model expects the H-1B program to add $1.3 trillion to GDP from 2023-2033 (i.e. $128 billion per year). Adopting the seniority-based (wage level) ranking proposed in 2020 would increase that by $61 billion per year over the next decade. In other words, seniority-based ranking would raise the total economic value of the H-1B program by 48% over ten years. Adopting a pure wage-based ranking would add $114 billion per year, or increase the economic value of the program by 88%. Adjusting for regional price-parity would account for geographic differences but would not significantly change the aggregate economic effect, which would come to $113 billion a year.

In other words, simply rearranging how visas are allocated could have the same effect on US GDP as increasing the cap by 88%.

These increases in H-1B compensation are associated with important changes to the composition of H-1B cohorts. First, the share of H-1Bs going to employers who employ lots of H-1Bs would diminish significantly. Under the lottery, an average of 29% of H-1Bs from 2018-2023 went to H-1B-dependent employers and 10% went to fee-paying employers. As can be seen in the figure below, any of the lottery alternatives would reduce the number of H-1Bs going to these companies which, we have seen, pay less.

[25] Sharma and Sparber, "Buying Lottery Tickets for Foreign Workers." https://doi.org/10.1016/j.jinteco.2024.103932

Replacing the lottery would end the stranglehold by outsourcers and staffing companies

Simulated average yearly change in new H-1Bs going to dependent or fee-paying employers, FYs 2018-2023

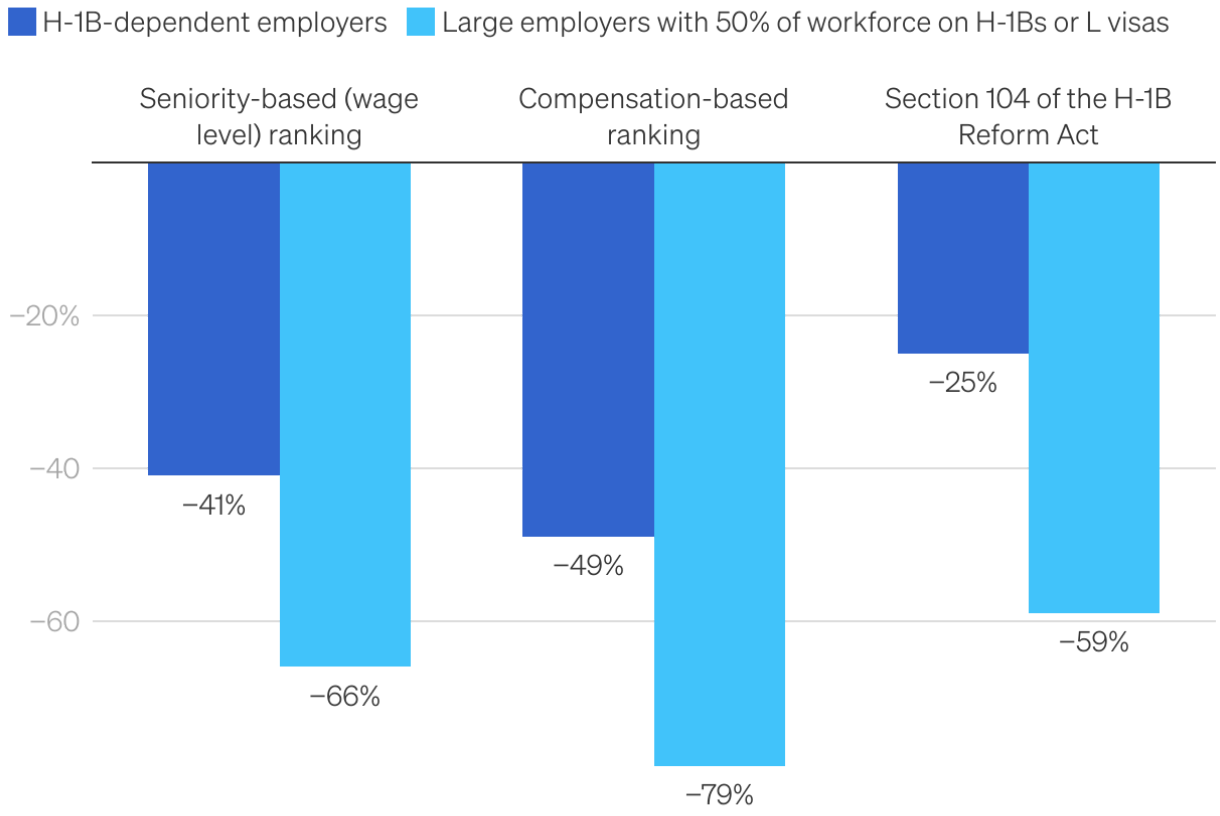


Chart: Jeremy Neufeld

Second, the educational attainment among H-1B recipients would also increase. The share of visas going to advanced degree holders would increase modestly under a seniority-based (wage level) ranking or compensation-based ranking (3% and 5% respectively), and the share going to doctoral graduates would increase significantly (increasing by 90% and 96% respectively). Section 104 of the H-1B Reform Act would more significantly increase the share going to advanced degree holders — by 52% — but this effect would be driven by gains among master's graduates. Doctoral graduates would get 67% more H-1Bs than under the lottery each year, but over 1,000 fewer H-1Bs than they would receive under a seniority-based (wage level) or compensation-based ranking system.

Finally, we turn to retention. One challenge posed by lottery alternatives is whether they would set back retention of international students. This was a major concern when the 2020 rule was under consideration. Before now, little data existed on the extent of the problem. Simulations suggest that the net effect on retention would be small for seniority-based ranking and compensation-based ranking, while Section 104 of the H-1B Reform Act would significantly increase retention for master's and doctoral graduates, while significantly reducing retention among bachelor's graduates. This analysis relies on patterns in H-1B status adjustments across different policy scenarios, using data on changes of status by education level. While this data tracks all H-1B holders who adjust their status and not only students, it serves as a good proxy for international student retention, since the majority of status adjustments (75% in FY2021) among H-1B holders are requesting changes of status as international students.[26]

The seniority-based (wage level) and compensation-based scenarios both represent moderate adjustments to the current lottery system, maintaining similar overall yearly shares of H-1Bs going to people changing status, averaging 63-64% over FYs 2018-2023. Both scenarios modestly redistribute visas away from master's degree holders changing status (from 45% in the lottery to 40% under both scenarios) and toward PhDs changing status (from 4% to 7% under both scenarios). The key difference between these two scenarios is that the compensation ranking allocates a slightly higher share to bachelor's degree holders seeking changes of status and has a slightly higher overall share going to those changing status.

In general, these results suggest that neither seniority-based or compensation-based ranking systems would have a negative net effect on retention of international students, contrary to some evidence suggesting otherwise using potentially unrepresentative data samples. While it is true that putting entry-level jobs at a relative disadvantage would reduce retention all else being equal, it appears to be outweighed by the fact that so many of the beneficiaries competing with international students would be put at a greater disadvantage.

Section 104 of the H-1B Reform Act, in contrast, would represent a dramatic departure from the current lottery system in how it affects retention. Given that there was enough demand for H-1B workers with advanced STEM degrees from US universities (the most preferred category under its ranking system) to meet the cap in FYs 2018-2022, the program would be almost entirely used to retain STEM master's graduates.[27] Section 104 allocates 98% of visas to beneficiaries changing status (vs. 63% in the lottery) and heavily favors master's degree holders changing status, who receive around 87% of visas. Bachelor's degree holders are completely excluded until FY2022, while PhD holders requesting changes of status receive a larger share than in the lottery, but smaller than under the compensation-based or seniority-based proposals. This makes it the most

[26] U.S. Department of Homeland Security, "Characteristics of H-1B Specialty Occupation Workers: Fiscal Year 2021 Annual Report to Congress" (Washington, DC: U.S. Citizenship and Immigration Services, March 2, 2022).https://www.uscis.gov/sites/default/files/document/data/H1B_Characteristics_Congressional_Report_FY2021-3.2.22.pdf

[27] FY2023 was the only year for which any H-1Bs would have been awarded under the second preference ranking to beneficiaries promised Wage Level 4 compensation.

radical reform option for retention, transforming the H-1B into a visa essentially reserved exclusively for retaining graduates of US universities, and not viable as a pathway for those who earned degrees abroad.

In the following sections, I will discuss the advantages and disadvantages of various replacements to the lottery. Throughout, it is important to remember that for the various tradeoffs, each alternative would significantly increase the economic value of the H-1B program, while reducing the ability for companies to treat H-1B workers like low-wage substitutes.

Seniority-based ranking and the 2020 H-1B selection rule

In President Trump's first administration, the Department of Homeland Security (DHS) attempted to replace the H-1B lottery through the rulemaking process. In November 2020, DHS issued a notice of proposed rulemaking on H-1B selection,[28] following up with a final rule in January 2021,[29] shortly before the next administration came into office. The rule never went into effect. After being delayed by the incoming Biden administration until December to ensure orderly implementation, the rule was eventually withdrawn in September following successful litigation. Notably, the opinion from the District Court was based on the fact that the rule was approved under Chad Wolf, who was not lawfully appointed as Acting DHS Secretary, rather than on the merits of the case against DHS authority to replace the lottery.[30]

The 2020 replacement for the lottery amounted to a seniority-based ranking. While the proposal is often described as a wage-based selection, this description is misleading because the rule did not assign visas to workers promised the highest wage, but to those who would be paid at the highest Occupational Employment Statistics (OES) prevailing wage levels. Prevailing wage levels are defined as the "average wage paid to similarly employed workers in a specific occupation in the area of intended employment."[31] Wages would therefore be used to rank petitions within occupations and geographical regions, but not across occupations and locations.

The four levels range from Level 4 ("fully competent") to Level 1 ("entry level"). In other words, the rule was effectively selection based on seniority.

Under the rule, DHS would order registrations by the highest prevailing wage level that their proffered wage surpassed. Then DHS would select H-1B petitions with the highest wage levels first. Starting with the highest level and going down the list until there were more registrations in the next level than remaining visas, a lottery would be used to select registrants within that wage level.

Advantages

When USCIS proposed adopting a seniority-based system, it published the major objectives of the proposed switch. In its final rule DHS stated that it expected that the rule would cause "an increase in productivity,

[28] Modification of Registration Requirement for Petitioners Seeking To File Cap-Subject H-1B Petitions, 85 Fed. Reg. 69236 (proposed November 2, 2020) https://www.federalregister.gov/documents/2020/11/02/2020-24259/modification-of-registration-requirement-for-petitioners-seeking-to-file-cap-subject-h-1b-petitions.

[29] Ibid.

[30] Chamber of Commerce of the United States v. United States Department of Homeland Security, No. 20-cv-07331-JSW (N.D. Cal. Sept. 15, 2021) https://fingfx.thomsonreuters.com/gfx/legaldocs/gdpzyqddyvw/IMMIGRATION_H1BRULE_INVALID_decision.pdf

[31] U.S. Department of Labor, Employment and Training Administration, "Prevailing Wage Information and Resources,"https://www.dol.gov/agencies/eta/foreign-labor/wages

measured in increased H-1B wages, resulting from the reallocation of a fixed number of visas from positions classified as lower-level work."

1. Significant economic improvement. The system would increase the total economic value of the H-1B program by 48% over ten years compared to the lottery system, representing approximately $61 billion per year in additional GDP contribution.

2. Higher compensation levels and reduced competition faced by American workers. The average compensation for H-1B workers would increase from $97,000 to $128,000 (a 31% increase), with improvements across all percentiles of the wage distribution.

3. Reduced H-1B-dependent employer usage. Would decrease visas going to H-1B-dependent employers by 41% and fee-paying companies by 66%, helping address concerns about outsourcing companies dominating the program.

4. Increased educational attainment. Would lead to a 3% increase in advanced degree holders and a 90% increase in doctoral graduates receiving H-1B visas, potentially boosting innovation and specialized expertise.

5. More predictable outcomes. Would reduce the uncertainty and waste associated with the current lottery system, potentially saving billions in costs associated with employers recruiting and registering for positions which lose the lottery.

6. Accounts for geography. Prevailing wage levels are based not only on the occupation, but also on the area of the worksite.

Disadvantages

Despite significant gains to efficiency, selecting by wage level has a few disadvantages compared both to random selection and compared to other lottery alternatives.

1. Puts early career workers like recent international graduates at a disadvantage.
   Since prevailing wage levels are designed to correspond to a worker's seniority in a given job, awarding H-1Bs by wage level puts entry-level and early career workers at a disadvantage. USCIS predicted that no visas would go to entry-level Level 1 workers.

2. Easier to game or manipulate than alternatives. Seniority-based selection is heavily reliant on the integrity of the LCA process. Employers may be able to game the LCA process by classifying positions as a lower paying occupation if the job they are filling can plausibly be classified under different codes. They may also classify a job as requiring less experience than what they will actually hire for. This may not prove as successful an allocation criterion as more objective features cannot be manipulated by sponsoring employers (like the actual wage, educational attainment, age, etc).

3. Limited cross-occupation comparison: The system only compares wages within occupations and geographical regions, not across them, potentially missing high-value candidates in high-value occupations.

4. Suboptimal effect on economy, compensation, and uncertainty. Does not eliminate as much uncertainty as alternatives. While representing a significant improvement over the lottery system, the seniority-based system would generate less economic value than a compensation-based ranking system (48% increase vs

88% increase in program value). USCIS predicted that under the proposed seniority-based ranking, a lottery would be used among all employers with offers in Level 2. While the scale of the uncertainty imposed by the lottery would be reduced, it would remain for all employers with offers within that category.

5. Discontinuous compensation pressure. Seniority-based ranking does not create any new incentive to offer greater compensation unless the offer will be so much higher that it moves to the next wage level. In other words, the positive pressure on compensation is not continuous but only exists in a few discrete jumps. Since USCIS predicts that all petitions for Level 3 and 4 workers will receive petitions, the system will only encourage higher offers if it is sufficiently high to bump the wage level from Level 1 to Level 2, or from Level 2 to Level 3. By contrast, increasing an offer from Level 3 to Level 4 or from a lower wage to a higher wage within a wage level will not increase an employer's likelihood of receiving a visa. This creates "dead zones" where there is no incentive for higher offers afforded by the allocation mechanism.

6. Startups may be at a relative disadvantage. Compensation packages at startups often include non-wage compensation including equity, which are not included in determining wage levels. This means that even though total compensation might be highly competitive, startups would be disadvantaged in the H-1B selection process since only the actual wages would be considered in the determination of wage levels before ranking.

Compensation-based ranking

Compensation-based ranking would improve the economic value of the H-1B program even more than the seniority-based ranking, and avoids the major disadvantages. Rather than assigning visas by lottery or OES wage levels corresponding to seniority as proposed by the Trump administration, a compensation-based ranking would simply assign visas to the employers offering the highest compensation, comparing individuals across industries and regions.

In effect, this kind of system is quite close to an auction system, advocated by many economists. The "winners" under a compensation-based system would essentially overlap with the winners under an auction, but guest workers and their employers would capture much of the benefit, rather than a share going to the government.

Assigning visas to the highest earning positions is expected to bring the most productive workers, given that a competitive labor market should pay workers their contribution to output. For this reason, economists like William Kerr have advocated for a compensation-based ranking to replace the lottery.[32]

Advantages

1. Maximum economic benefit. Would generate the highest economic value among all proposed alternatives, increasing the program's contribution to GDP by 88% over ten years (approximately $114 billion per year in additional GDP), nearly double the improvement from the seniority-based system.

2. Highest levels of compensation. Would increase average H-1B compensation to $137,000 (a 41% increase from the lottery), with particularly strong improvements at both the 25th percentile (48% increase) and 75th percentile (51% increase). This also establishes the highest floor on H-1B wages of any alternative.

[32] William R. Kerr, *The Gift of Global Talent: How Migration Shapes Business, Economy & Society* (Stanford, California: Stanford Business Books, an imprint of Stanford University Press, 2019).

3. Strongest reduction in outsourcing. Would most effectively reduce visas going to H-1B-dependent employers (49% reduction) and fee-paying companies (79% reduction), helping combat program abuse more effectively than other alternatives.

4. Protection of early-career workers. Unlike the seniority-based system, early-career workers in high-paying occupations (like physicians and engineering managers) can still qualify since their absolute compensation is compared across all occupations.

5. Educational attainment boost. Would increase advanced degree holders by 5% and nearly double the number of doctoral graduates (97% increase) without explicitly targeting education levels.

6. Drastically diminishes waste and uncertainty. Almost all of the uncertainty of the lottery would be eliminated by a wage-first ranking. Most employers would have a clear forecast whether a wage offer will be high enough to secure a visa or not, bringing the number of visas demanded and supplied into balance. This is estimated to avoid over $1 billion in costs each year.

7. Provides information to policymakers about H-1B demand and economic value. Trends in the minimum salary that still secured a visa would provide lawmakers a new source of information. If the minimum salary is trending upwards from year to year, it may indicate there is a shortage of visas holding back economic progress and might need to be raised. If it's collapsing, then it could be evidence that the visa is being used to undercut Americans or exploit low-wage sources of labor. Furthermore, the current lottery system can obscure the underlying need for workers because it only includes employers who are willing to take on the risk of entering the lottery. As a result, the number of H-1B registrations is a mixed signal about the demand for workers and the risk-aversion of employers, making it difficult for lawmakers to accurately think about the appropriate cap for the program. A compensation-based system, on the other hand, would provide a more transparent signal about the demand for H-1B labor and would allow lawmakers to set the cap in a way that ensures that increasing it does not lead to the influx of low-wage labor.

Disadvantages

1. Geographic distribution favors higher cost regions. Using offered compensation does not account for differences in the cost of living in different regions, and may shift production toward places with higher costs. However, adjusting for regional price parity can address geographic heterogeneity without significantly reducing the economic benefits of compensation-based ranking. My simulations indicate that adjusting for regional price parity would only reduce the national effect on GDP by about $700 million each year over the next decade.

2. Snapshot effect: Using raw job offers will only capture a snapshot of the contribution in the first year. Without age adjustments, ranking by compensation therefore may not account for the full future potential and lifetime contributions of younger workers who start at lower salaries but have high growth potential. However, an age adjustment can correct for this bias.

3. Does not capture spillover effects. If markets are competitive and there are not major spillover benefits, then compensation is basically ideal to estimate the economic value of an immigrant in a given year. But these conditions do not always hold. For example, some workers make those they work with more productive, a benefit that may not be captured in compensation. Or if a worker invents a product she is unlikely to capture most of the value of, a salary ranking may miss these benefits as well. These concerns can be overstated: if salary is still correlated with these kinds of spillovers, it may still be a strong selection method. In short, salaries are still one of the strongest signals available.

Other spillovers may be associated with the industry or kind of company rather than with the worker. For example, startups may be more likely to drive job creation and innovation than other companies but may rely more heavily on equity to attract talent compared to established companies. In any case, without data on startups' salaries, it is difficult to say whether compensation-based ranking would harm startups relative to the status quo. While the salary component of total compensation may be lower at startups than for similar jobs at established companies in the same field, it may nevertheless be more than sufficient to secure a visa given that startups would no longer have to compete with lower paying industries and occupations like IT. Fortunately, compared to seniority-based ranking which is entirely reliant on wage levels, compensation-based ranking would allow for the accounting of equity and other non-salary compensation, though annualizing equity compensation and accounting for equity in early-stage pre-valuation startups pose challenges.

A points-system could afford the opportunity to start with salary and "fine-tune" the ranking with other metrics, but it is not clear that a salary-ranking will be systematically biased or worse than any particular points-system.

Points-based and preference systems

A final promising alternative to the lottery comes in the form of points systems and preference systems, which let lawmakers assess the talent pool using any variety of factors they like. A preference system requires a complete ranking of every combination of relevant traits. A points-system is probably more flexible and assigns scores to different traits which can be summed up and compared.

Such systems have existing support in Congress. To give one example, Senators Durbin and Grassley have repeatedly introduced a version of a bipartisan bill called the H-1B and L-1 Visa Reform Act since 2007 that would make many major changes to the H-1B and L-1 visa programs. Section 104 of the bill would replace the lottery with a preference system under which visas would be awarded in the following order:

1. International students with advanced STEM degrees from American institutions
2. Workers paid over the median wage for OES skill level 4
3. International students with other advanced degrees from American institutions.
4. Workers paid over the median wage for OES skill level 3
5. International students with STEM bachelor's degrees from American institutions
6. International students with other bachelor's from American institutions
7. Workers in Group I Schedule A occupations (i.e., shortage occupations)
8. Workers employed by employers meeting criteria for good corporate citizenship
9. Others

Advantages

1. Strongest support for American education. Would significantly increase visas going to US university graduates, with a 56% increase in visas for F-1 students and others already in the US, and a 52% increase for advanced degree holders.

2. Flexible for accomplishing different goals. Compensation-based or seniority-based rankings are optimizing for just one characteristic of interest. However, lawmakers may care about other things such as the ability to retain students, growing American human capital in certain fields, employer behavior, and other factors. These can be easily embedded in a points-based or preference system.

3. Political viability. The H-1B Reform Act has buy-in from lawmakers. A perfectly designed allocation system designed by an economist in an ivory tower is worth little if it never gets used. Proposals with support from policy makers, like Section 104 of the H-1B and L-1 Reform Act, may be more likely to pass. Political issues not addressed by a simpler system can be addressed at the margins through adding points.

4. Predictable. A preference system and points-based systems creates clear lists of criteria so registrants can know in advance where they fall in the rankings. Combined with historic data on how many points or preference categories beneficiaries receive in each of the rankings, this creates a highly predictable system where both employers and workers will know their likelihood of success if they seek a visa. This predictability will significantly reduce waste and uncertainty, but may not do so as much as alternatives.

Disadvantages

1. Exclusion of international talent. Would effectively close off H-1B opportunities for graduates of non-US universities, including many of the world's top institutions, potentially limiting the global talent pool.

2. Overemphasis on education. Heavily weights educational credentials, despite evidence suggesting that education is not as strongly correlated with immigrant success as commonly assumed.[33]

3. Misaligned incentives. Creates potential distortions in educational and career choices. For example, candidates might pursue unnecessary additional degrees purely to improve visa chances rather than for skill development. As the absolute number of STEM master's graduates grows, STEM PhDs will likewise find intense competition for cap-subject H-1Bs and may choose to stay in academia. Further, educational institutions' incentives would also be distorted by the opportunity to profit from international students' inflated interest in advanced degrees.

4. Lottery persistence. May effectively function as a random lottery system within the highest preference tier in years when there are sufficient demand in that category, merely shifting the lottery to a more restricted pool rather than eliminating it.

5. Suboptimal performance on major metrics. Would actually decrease average compensation compared to the lottery system in the initial years though showing potential for modest increases in later years. This generates the smallest economic gains among alternatives (35% increase in the economic value of the program versus 48% for seniority-based and 88% for compensation-based systems), and over 1,000 fewer visas for doctoral graduates compared to either the seniority-based or compensation-based systems.

6. Discontinuous effects. Section 104 of the H-1B Reform Act would create similar discontinuous incentives to seniority-based ranking due to its strict preference tiers. Since in most years simulations show all visas going to advanced STEM degree holders from US universities, the system gives no incentive for paying higher wages, good corporate governance, or any other of the factors it intends to encourage. A preference system is not as well-suited as a points-based system for trading off strengths of many criteria simultaneously. While preference systems may consider numerous factors, they still rely on an ordinal ranking system that means any factor higher on the list outweighs lower-ranked factors, even if a worker meets many of the lower-ranked factors. For this reason, a points-based system incorporating many of the features of Section 104 of the H-1B Reform Act but without a rigid ranking would allow for more continuous incentives (to enroll in E-Verify, for example).

[33]Simone Bertoli and Steven Stillman, "All That Glitters Is Not Gold: Wages and Education for US Immigrants," *Labour Economics* 61 (December 2019): 101749, https://doi.org/10.1016/j.labeco.2019.101749.

IV. Conclusion

The random H-1B lottery significantly erodes the potential value of the H-1B program and should be replaced. Indeed the agency tried to do so in 2020 with a seniority-based ranking. A compensation-based system has a number of advantages over the previous USCIS rule: greater benefits to the American economy, fewer visas to H-1B-dependent employers, and greater retention of international students. Nevertheless, a points-based system could allow policy makers to address remaining drawbacks of compensation-based selection and also capture benefits from potential spillovers not likely to be captured by the worker's compensation.

Random selection is a major source of the program's dysfunction. The most valuable and highly-specialized workers are routinely rejected in favor of replaceable entry-level workers while high-profile stories about native workers training replacements make the program unpopular and viewed with suspicion. Against this background, it's no surprise that calls to raise the cap have so far fallen on deaf ears.

Replacing random selection could change that. Indeed, it's worth the same to GDP as 75,000 more visas per year.

Appendix

A1: Data and simulation methods

To compare these alternatives, I simulate what the allocation of new H-1Bs would have looked like under each system from FYs 2018-2023, using microdata on over 2.5 million I-129 petitions filed in FYs 2017-2022 that I obtained from USCIS via a FOIA request.

I start by limiting my sample to only approved I-129s for new employment (since renewals are not subject to the cap or the lottery), cap-subject H-1Bs, which yields 512,951 observations. Some of the beneficiary compensation records have clear errors, which I try to resolve by using annualized wages when they are inconsistent by about a factor of ten and reported compensation would be less than $15,000 or greater than $500,000. I also drop all remaining observations where earnings are not at least four digits.

The data for I-129 petitions does not include OES wage levels so this must be inferred. First, I associate the worksite zipcode (or the petitioner zipcode when the worksite zip is not available) to a core-based statistical area (CBSA), using the CBSA-Zip Code crosswalk from the Department of Housing and Urban Development. When a zip code maps to more than one CBSA, I choose the one with the highest relative area. I also associate every Dictionary of Occupation Title (DOT) code to the most appropriate 6-digit Standard Occupational Classification (SOC) code. This allows me to match records to the Office of Foreign Labor Certification's historical wage data. Specifically, I use Alien Labor Certification (ALC) data from FYs 2020-2021 to infer a wage level for each I-129 observation, based on its corresponding SOC-designated occupation and matched geographic area. To determine the preference ranking under Section 104 of the H-1B Reform Act, I assume a beneficiary has a US degree if they are requesting a change of status from an existing visa and I assume they have a STEM degree if they work in a STEM field (i.e., with a DOT code less than 50).

Across 20,000 simulation runs, I simulate the yearly talent pool from FYs 2017-2022 by resampling from each year's approved petitions. Given that the 20,000 H-1Bs reserved for those with US master's degrees and higher increases the likelihood of selection for eligible beneficiaries, I do not sample directly from the complete pool of approved cap-subject petitions for new employment. Rather, I first sample from the subset of approved petitions who indicated in Section 3, Question 1 of their H-1B Supplement form that they are petitioning under the master's cap. From this subset, I sample (with replacement) up to the the demand for eligible master's cap visas

$\left|I_R\right|$ implied by the total number of registrations or petitions in that year ($|I|$), the number of visas actually awarded under the master's cap ($\left|\mu(I_G)\right|$), and the implied quotas for that year ($q_r = 20,000$ and q_u is the remainder of the approved petitions in that year):

$$\left|I_R\right| = |I| - \left|I_G\right| = |I| - \frac{\left|\mu(I_G)\right|}{q_u}(|I| - q_r).^{34}$$

Then, for the demand for eligible bachelor's cap visas $\left|I_G\right|$, I sample (with replacement) from the subset who indicated they were petitioning under the bachelor's cap.

From this simulated talent pool for each year, I then follow the rules dictated by each of the selection mechanisms, drawing first from the entire pool the actual number of approved petitions under the bachelor's cap in that year. Then from among the remainder, I identify which are US master's cap petitions and draw the actual number of approved petitions for the US master's cap in that year.

The estimates throughout this paper represent the average yearly result of 20,000 simulations of each allocation system for FYs 2018-2023.

A2: Modeling the direct effect on GDP

In each year t, the government awards a fixed quantity of visas, N, to a new cohort i of guest workers through allocation mechanism α, where $i = t$. In the first year of analysis, t_0, we know that the representative worker in the first cohort $i = t_0$ is paid $\overline{w}_\alpha$. Then, in any subsequent year t, the representative visa recipient of any cohort i such that $t \geq i$ receives earnings given by:

$$w_{\alpha,it} = \overline{w}_\alpha(1 + \gamma_\alpha)^{i-t_0}(1 + \eta)^{t-i},$$

where γ_α denotes the yearly growth rate in the initial earnings offered to new cohorts of visa recipients under allocation mechanism α and η denotes the yearly growth rate in earnings for an individual guest worker in the United States. Notably, γ_α incorporates not only improvements in labor productivity in the United States that will also captured by η, but is also determined by increases in the available pool of human capital abroad and

[34] Parag A. Pathak, Alex Rees-Jones, and Tayfun Sönmez, "Immigration Lottery Design: Engineered and Coincidental Consequences of H-1B Reforms," *Review of Economics and Statistics* 107, no. 1 (January 3, 2025): 1–13, https://doi.org/10.1162/rest_a_01252.

improvement in recruitment capacity (which would not affect η, which tracks the lifetime income trajectory of particular individuals).

Visas can be renewed indefinitely, but the cohort loses a fraction, ρ, of its members each year by attrition. Attrition can be caused by emigration (voluntarily or forcibly after a layoff or denied renewal), death, or retirement. Adjusting status to a green card would not count as attrition because the worker is still retained in the labor force. The size of a given cohort at a given time is therefore given by:

$$n_{it} = N(1 - \rho)^{t-i}.$$

Then, given the labor share of income λ, we can calculate total income y_α contributed by all visa recipients under allocation mechanism α from year a to year b:

$$y_\alpha = \frac{1}{\lambda}\sum_{i=a}^{b}\sum_{t=i}^{b} w_{\alpha,it} n_{it} = \frac{\bar{w}_\alpha N}{\lambda}\sum_{i=a}^{b}\sum_{t=i}^{b}(1+\gamma_\alpha)^{i-t_0}[(1-\rho)(1+\eta)]^{t-i}.$$

Notably, this model will yield conservative estimates. It ignores important indirect ways that replacing the H-1B lottery would increase GDP. Most importantly, I ignore any effect that replacing the lottery could have on productivity growth or the productivity of natives. This static assumption makes the modeling easier, but is not as realistic as a dynamic model that captures the important effects of greater innovation.

A3: Estimating the direct effect on GDP

To get parameter values, I simulate the average compensation offered to new visa recipients under each allocation mechanism from FYs 2017-2022. The value for $\bar{w}_\alpha$ comes from taking the average yearly simulated compensation under allocation mechanism α, associated with $t_0 = 2019.5$, the median year over the period. For $\gamma_{\alpha'}$ I take the simulated average yearly growth rate in the average compensation offered to new visa recipients under α from FYs 2017-2022.

For δ, I conservatively assume 3% yearly wage growth, following the assumptions used by Thomas Church for wage growth among H-1B recipients present in the United States.[35] I also follow Church in choosing 10% as a

[35] Thomas V. Church, "Estimating the Economic and Budgetary Effects of New H-1B Visas in the Senate Gang of Eight's Proposed Immigration Bill" (Stanford, CA: Hoover Institution, Stanford University, May 7,

conservative estimate for ρ. For N, I use the statutory quota of 85,000 for cap-subject H-1Bs. For the labor share λ, I use the CBO's projected labor share of 58% through 2032.[36]

With these parameters, I use the formula from Appendix 2 to estimate cumulative contribution to output from 2024-2033.

A4: Estimating the search cost externality of the lottery

In the paper "Buying Lottery Tickets for Foreign Workers: Lost Quota Rents Induced by H-1B Policy" in the *Journal of International Economics*, Sharma and Sparber model the search cost externalities imposed by the lottery and the quota.[37] The magnitude of the externality is sensitive to the method of estimating a parameter ψ, the elasticity of the probability of winning the lottery with respect to the visa cap N. They offer three different methods, which differ mainly in how many visa petitions or registrations would be received in the absence of the lottery. Because my paper is interested in allocation mechanisms dependent on observable traits, it is reasonable to assume that the number of visa registrations would equal the cap. This means the applicable method of estimating ψ is given by their first method, $\psi = \frac{ln(\pi)}{ln(\pi+\phi)}$, where π is the probability of winning the lottery given the number of registrations filed and ϕ is visa registrations in excess of the real demand.

Solving their model for the magnitude of the total search cost externality, C, in a given year with this method of computing ψ gives us: $C = -N(w^O - w^F)ln(\frac{\pi}{\pi+\phi})$, where $(w^O - w^F)$ is an "outsourcing premium," which they estimate at $23,500. With this formula, we can extend and refine their estimates to cover the period 2014-2023 for which we have data on H-1B registration and petition rates. In the chart below, the third column replicates Sharma and Sperber's estimate for the size of the search cost externality exactly, and expands it out to 2023. However, Sharma and Sperber note that their estimate may be too large because they assume fixed real demand from 2009 to estimate ϕ. Given that real demand for H-1Bs has almost certainly increased, I calculate ϕ by assuming real demand is proportional to either the number of registrations in years for which the registration system was in existence or the number of petitions prior to the registration system. I use their estimate of

2013).https://www.hoover.org/sites/default/files/uploads/aafs/2013/05/Estimating-the-Economic-and-Budgetary-Effects-of-H-1B-Reform-In-S.744.pdf

[36] Congressional Budget Office, "The Budget and Economic Outlook: 2022 to 2032" (Washington, DC: CBO, May 2022). https://www.cbo.gov/publication/57950 "

[37] Sharma and Sparber, "Buying Lottery Tickets for Foreign Workers." https://doi.org/10.1016/j.jinteco.2024.103932

demand in 2009 to calculate the scaling factor. This leads to lower estimates of the externality cost of the lottery, shown in the fourth column in the table below, but is likely more accurate. To estimate the effect of replacing the lottery over ten years through ending these externalities, I use the average estimated search cost externality for the last five years of data (i.e, 2021-2025) using the more accurate ϕ. This comes out to $19 billion over ten years.

Search cost externalities associated with the lottery by year

Year	Lottery entries	Externality (with Sharma and Sperber's preferred Φ)	Externality (with modified Φ)
2014	124,000	$200M	$700M
2015	172,500	$1B	$1B
2016	233,000	$1.8B	$1.2B
2017	236,444	$1.8B	$1.2B
2018	199,000	$1.4B	$1.1B
2019	190,098	$1.3B	$1B
2020	201,011	$1.4B	$1.1B
2021	275,000	$2.1B	$1.4B
2022	308,613	$2.4B	$1.5B
2023	483,927	$3.4B	$2B
2024	780,884	$4.4B	$2.7B
2025	479,953	$3.3B	$2B

Table: Jeremy Neufeld

A5: Estimating the effect on dependent visas

Ending the lottery does not only change the composition of H-1B workers, but also of the family members they are allowed to bring with them. Most importantly, H-1B workers can bring their spouses on H-4 visas, who can also work because of a 2015 executive order which makes them eligible for work authorization. Because of assortative mating, the earning power of H-1B workers is correlated with their H-4 spouses.

To account for this effect, I make a simple modification to the formula in Appendix 2 by including a scaling factor, $k = m \times e \times d$, where m is the share of H-1B workers who have an H-4 dependent spouse, e is the share of H-4 spouses who are employed, and d is how much employed H-4 spouses make as a share of their spouse's earnings. For m, I follow Thomas Church's estimate that 40% of H-1B workers are married.[38] For e and d, I turn to data collected by Ike Brannon and M. Kevin McGee in a survey of over 4,708 H-4 holders in 2018, which suggests that 62% of H-4 spouses are employed and that they make $77,000 on average, which is 74% of the average compensation of all H-1B beneficiaries in 2018, according to USCIS data.[39] This gives us an estimated value for k: $k = .184$.

A6: Summing up

Adding up the main effect from A2 and A3 with the indirect effects from A4 and A5, we can finally estimate the total effect of replacing the lottery, which can be seen in the table below. As can be seen below, replacing the lottery would conservatively add hundreds of billions of dollars to American GDP over ten years. This represents a significant increase in the value generated by the H-1B program.

Under the status quo, my model expects the H-1B program to add $1.3 trillion cumulatively to GDP from 2023-2033, averaging $128 billion a year. Adopting the seniority-based ranking proposed in 2020 would add $61 billion. In other words, seniority-based ranking would raise the total value of the H-1B program by 48% over ten years. Adopting a compensation-based ranking (with or without an adjustment for regional price parity)

---

[38] Church, "Estimating the Economic and Budgetary Effects of New H-1B Visas." https://www.hoover.org/sites/default/files/uploads/aafs/2013/05/Estimating-the-Economic-and-Budgetary-Effects-of-H-1B-Reform-In-S.744.pdf

[39] Ike Brannon and M. Kevin McGee, "Repealing H-4 Visa Work Authorization: A Cost-Benefit Analysis" (April 2, 2019), SSRN Scholarly Paper. https://ssrn.com/abstract=3349786 and U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, "Characteristics of H-1B Specialty Occupation Workers: Fiscal Year 2018 Annual Report to Congress" (Washington, DC: USCIS, 2018). https://www.uscis.gov/sites/default/files/document/reports/Characteristics_of_Specialty_Occupation_Workers_H-1B_Fiscal_Year_2018.pdf

would add $1.1 trillion to total income over ten years, or increase the value of the program by 88%, nearly twice that of the seniority-based system. More modestly, Section 104 of the H-1B Reform Act would add $361 billion over the same period, increasing the value of the H-1B program by 33%.

Average yearly effect on US GDP by replacing H-1B lottery, 2026-2035

	Seniority-based (wage level) ranking	Compensation-based ranking	Compensation-based (RPP-adjusted)	Sec. 104 of H-1B Reform Act
H-1B contribution	$50B	$95B	$94B	$36B
H-4 contribution	$9B	$17B	$17B	$7B
Externality reduction	$2B	$2B	$2B	$2B
Total	$61B	$114B	$113B	$45B

Table: Jeremy Neufeld