

## **A Response to the *Washington Post* regarding “H-1B Visas and the STEM Shortage”**

Jonathan Rothwell and Neil G. Ruiz  
October 2014

A recent *Washington Post* article raises questions about the methodologies and aims of research we conducted in 2013 regarding the H-1B visa program and STEM (science, technology, engineering, and mathematics)-related jobs. This note attempts to address those questions.

In an effort to better understand issues related to the immigrant and skilled labor force, we analyzed a unique database, which includes the earnings, education, and age of H-1B visa holders. It was originally acquired via a Freedom of Information Act request by economists Magnus Lofstrom and Joe Hayes, who shared the data after one of us, Neil Ruiz, requested it.

Our article, [H-1B Visas and the STEM Shortage](#), was published on the Brookings website on May 10, 2013. We also published a [companion working paper](#) through the Social Science Research Network that same day. Even having developed the research over a short one-week time period, we managed to solicit pre-publication comments from six scholars, including one noted critic of the H-1B program, for both the article and working paper.

Despite the relative informality of the analysis and its brief content, the piece has generated considerable attention, mostly positive, from the public and other scholars. Yet, critics of the H-1B program have raised some methodological objections. With this brief document, we aim to answer the criticisms that could be perceived as having scholarly merit.

The criticism has focused on our regression analysis that compares H-1B visa holders' earnings to the earnings of U.S.-born workers, as reported in 2010 U.S. Census microdata.<sup>1</sup> In that analysis, we control for age, age-squared, and education. This is a very standard model in labor market economics. In different iterations of the model, we also control for occupation and industry, defined with various levels of detail. In each case, we find that the average H-1B worker earns significantly more than U.S.-born workers, overall and conditional on those factors.

### **1. How we measured education in the statistical analysis**

One critic claims that we commit a fundamental error in our analysis because we use an ordinal variable for measuring education, rather than breaking it up as a categorical or dummy variable. This applies to columns 3, 4, and 5 of Appendix Table 2 in the working paper version. Yet there is no theoretical reason why this would bias the results in favor of H-1B visa, and indeed, it does not.

We re-analyzed the data controlling for categorical dummy variables for doctoral and professional degree holders and those with a master's degree (omitting the bachelor's degree category). The adjusted R-squared results were identical to those for the previous regressions, as were the coefficients on H-1B variables for columns 4 and 5. The only difference is that in column 3, the coefficient would have changed from 0.249 to 0.247. In both cases, it rounds to a 25 percent wage premium for H-1B workers. This is obviously not a fundamental error because it does not change the results in any meaningful way.

## **2. Omitted skills bias**

A second criticism is that we do not account for “skill sets.”<sup>2</sup> Indeed, no variable that measures “skill sets” is observed in either database. This is standard in labor economics. No public database contains information on skill sets, which has not stopped the field of economics from publishing thousands of papers on earnings. Some databases contain information like scores on cognitive exams, but this does not apply to either of our two databases or any database we know of that contains information about H-1B workers. Typically and canonically, occupation, age, and education are used as proxies for skills, which is what we did.

That is the practical reason why the criticism is not a “fundamental error,” as claimed, but theoretical reasoning also makes it unlikely that addressing this criticism would change our conclusions. Imagine that we included an accurate measure of the value of worker skills in the regression from Appendix Table 2 column 4. If H-1B workers had less valuable skills than U.S. born workers in the same occupation with similar experience and education levels, this would increase the coefficient on H-1B workers, suggesting an even larger premium. This would not change our main conclusion that H-1B workers are compensated more than U.S.-born workers, conditional on observable characteristics, though it would be difficult to explain.

Another possibility, which the criticism implies, would be that including this variable would reduce the coefficient on H-1B workers enough to make it statistically indistinguishable from zero or even make it negative and significant. This would mean that high-value skills were either highly correlated with H-1B workers or extremely highly correlated (if the H-1B variable turned negative). In other words, it would mean that H-1B workers have mastered the most valued skills of computer workers and other workers in technical fields to a greater or much greater extent than their U.S.-born counterparts with the same education, experience, and occupation.

A less extreme version of this is exactly the cautious interpretation we offer in our analysis. So, on this point, there is no disagreement. We believe it is likely that the average H-1B worker possesses somewhat more valuable technical skills than the average U.S.-born worker in the same occupational class, with the same level of education and experience. We believe this explains the wage premium, rather than some other explanation—like employers discriminating in favor of foreign-born workers.

We do not claim to know whether or not the average H-1B worker with the same resume and programming skills, in the case of a software developer, would be paid the same, more, or less than their average U.S.-born counterpart. Such an analysis would also need to factor in other aspects of skill and value, like the ability to communicate or manage effectively and the added

costs and delays of filing the H-1B paperwork. That information is unlikely to be available through public databases and may not even be readily available to employers.

Even if it turned out that H-1B workers had greatly more valuable skills than U.S. born workers but—as a result—were paid slightly less than their otherwise identical counterparts, then the program could still be playing a useful role in relieving shortages for those highly valued skills. Other evidence suggests that employers face high levels of hiring difficulty for many valuable computer and other STEM skills.<sup>3</sup> Combining that information with the low unemployment rates of computer and STEM workers generally, implies, that very few U.S.-born workers with the most valuable STEM skills are unemployed. In any case, we can conclude that our findings are inconsistent with claims, based on less reliable data, that employers pay H-1B workers less than U.S.-born workers in the same occupation.<sup>4</sup>

### **3. Geography**

A third criticism is that we ignore geography and cost-of-living differences.<sup>5</sup> As it happens, our administrative records do not contain the location of the H-1B workers, so this amounts to criticizing us for even conducting the analysis with administrative records.

It is also not clear that one should adjust for cost-of-living differences. A prominent line of urban economics theory argues that some cities are more expensive because workers there are more productive.<sup>6</sup> If so, then adjusting for costs of living also adjusts for unobserved skill, which will tend to drive down the coefficient on H-1B workers without shedding light on whether they are paid at or above the market wage, conditional on observables.

Still, we attempted to formally address this criticism. To estimate the likely distribution of H-1B workers, we use data on the geography of H-1B requests from the Department of Labor LCA records. Only a percentage of these requests apparently result in actual H-1B approvals, given the cap on visas and other factors. Combining these geography data with Regional Price Parity data from the Bureau of Economic Analysis allows us to compare the local cost of living for the average H-1B worker to the local cost of living for the average employed American with at least a bachelor's degree. The price index is 105.9 for H-1B visa holders and 101.0 for U.S.-born workers. The index for U.S.-born computer workers is 102.4. In other words, the average H-1B visa holder lives in an area in which the cost of living is about 3 to 5 percentage points higher than for U.S.-born workers with similar levels of education in similar occupations. These differences are not nearly enough to explain the observed differences in earnings and could be attributable to higher worker productivity.

### **4. Timing of H-1B workers in their careers**

A fourth criticism is that we “look only at wages at the time of hire, thus failing to sample the H-1Bs at times during which they are most underpaid, since H-1Bs receive smaller raises than comparable Americans.”<sup>7</sup> In fact, our database contains both new H-1B workers and those renewing their H-1B status after working as an H-1B visa holder for three years (and, in some cases, adjusting from another temporary immigration status). The latter represent approximately 60 percent of the sample.

Because the database does not track individuals over time, it cannot show whether or not individual H-1B workers see faster or slower wage growth than similar U.S.-born workers, but it is incorrect to state that we only observe them at the time of their initial hiring. We observe them at various stages of their career, while still working under the H-1B visa program. Those sponsored on a continuing visa tend to make slightly more than new H-1B holders, controlling for age, education, and occupation, which is inconsistent with the suggestion that this is the time when they are “most underpaid.”

## **5. Occupational classifications**

Finally, we are criticized for not comparing H-1B workers to U.S.-born workers using detailed occupational categories.<sup>8</sup> This is not so. We show the less detailed occupational comparisons in a summary table to simplify the analysis, but we also compare the results using the most detailed occupational classifications, and Appendix Table 2 in our report has always indicated that.

### **Summary**

We do not contend that our analysis is the last word on whether H-1B workers are treated well or paid wages more or less than comparable Americans.

As we explicitly stated, we believe more research with better data should be conducted, whether by us or other scholars interested in the issues. We offered no policy recommendations as to the number of visas that should be given out each year, only that the level of visas available and other aspects of the program should be better informed with data and analysis. We do not believe this is an especially controversial point, and it is shared by those who are otherwise more critical than we are of the H-1B program.<sup>9</sup>

These responses hopefully make clear that any suggestion that our analysis was biased toward the priorities of industry or any other group is simply without merit. As is the case with all Brookings research, we pursued this analysis with a commitment to its quality, independence, and impact. Our conclusions and recommendations are solely our own, and were not determined or influenced by any donation or other third party.

---

<sup>1</sup> Professor Norm Matloff's H-1B Web Page, <http://heather.cs.ucdavis.edu/AnnBib.pdf> (accessed October 12, 2014).

<sup>2</sup> Ibid.

<sup>3</sup> Jonathan Rothwell, "Still Searching: Job Vacancies and STEM Skills," (Washington: The Brookings Institution, 2014).

<sup>4</sup> John Miano, "Low Salaries for Low Skills: Wages and Skill Levels for H-1B Computer Workers, 2005" (Center for Immigration Studies, 2007), available at <http://cis.org/LowSalariesforLowSkills-H1B>

<sup>5</sup> Professor Norm Matloff's H-1B Web Page, <http://heather.cs.ucdavis.edu/AnnBib.pdf> (accessed October 12, 2014).

<sup>6</sup> See Edward L. Glaeser and Joshua D. Gottlieb "The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States," *Journal of Economic Literature* (2009) 47 (4): 983-1028. They write, "While correcting for national price levels almost always makes sense, there is considerable information in local incomes that is lost by correcting for local price levels. When we assume that firms

---

behave competitively, the marginal product of labor will be reflected in nominal local wages—not wages corrected for local prices. That information can be lost when we correct for local prices.”

<sup>7</sup> Ibid.

<sup>8</sup> Ron Hira, Economic Policy Institute, <http://www.epi.org/blog/brookings-1b-reports-flawed-analysis-flawed/> (accessed October 12, 2014).

<sup>9</sup> Michael S. Teitelbaum, *Falling Behind? Boom, Bust, and the global Race for Scientific Talent* (Princeton, New Jersey: Princeton University Press, 2014).