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Chapter Author(s): John Bound

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Comment

John Bound

In this chapter Hanson and Slaughter use data from the decennial census, the American Community Survey (ACS), and the Current Population Survey (CPS) to document the rapid growth of the foreign born among US STEM workers. The data used by Hanson and Slaughter do not allow them to identify individuals by visa status. Extending tabulations originally done by Lowell (2000) and Bound et al. (2015) estimate that, as of 2000, close to 500,000 individuals were working in the United States on H-1B visas. The census data Hanson and Slaughter use show 793,000 foreign-born full-time employees working in STEM occupations as of 2000. Since almost all workers on H-1B visas are working in STEM fields, it seems safe to assume that most of the foreign born in Hanson and Slaughter's tabulations are on H-1B visas.

These foreign-born workers appear to be quite productive. Indeed, controlling for education, gender, race, and region, foreign-born STEM workers living in the United States at least six years appear to earn a small premium (roughly 5 percent) over their US-born counterparts. However, those more recently immigrated appear to earn somewhat less than their US counterparts.

As Hanson and Slaughter point out, this pattern of earnings is consistent with a number of very different and not mutually exclusive explanations. First, selection could explain increasing relative earnings among the foreign born. It seems plausible that very productive foreign-born workers are more likely to have employers sponsor them for permanent residency in the United States. If the most productive workers tend to stay, this could explain the observed patterns of earnings. Second, the pattern could simply reflect the acquisition over time by foreign-born workers of skills that are rewarded by the US labor market.

A third explanation for the earnings pattern is found in the cross-employer mobility limitation imposed by the H-1B visa program. Critics of the program say this constraint gives employers some monopsony power over H-1B workers, which could explain their lower relative earnings in the years immediately following immigration to the United States.

While no evidence incontrovertibly demonstrates cost or productivity advantages associated with hiring the foreign born, it seems clear that such advantages must exist. Since the middle of the first decade of the twenty-first century, the H-1B cap has always been reached, often relatively early

John Bound is professor of economics at the University of Michigan and a research associate of the National Bureau of Economic Research.

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in the fiscal year, suggesting the demand for H-1B workers substantially exceeds the quota-determined supply. This excess demand persists despite both pecuniary and nonpecuniary costs associated with hiring foreigners on H-1B visas. For instance, a recent GAO survey found legal and administrative costs to range from $2,300 to $7,500 for each H-1B hire (US General Accounting Office 2011).

How Essential to the STEM Workforce Are the Foreign Born?

In their introduction, Hanson and Slaughter seem to suggest that foreign-born scientists are essential to the US world leadership in science and technology—pointing to the poor overall performance of US students in math and science and the US demand for foreign labor.

This story is not as self-evident as it might seem from Hanson and Slaughter's tabulations. The United States has maintained a dominant position in science and technology since the end of World War II, despite having a small foreign-born STEM workforce throughout the 1960s, 1970s, and 1980s, and a public education system that was no better then than it is today.

Understanding the impact that increased high-skilled immigration has had on the US economy ultimately involves evaluating counterfactuals. A very simple, static, partial equilibrium model can illustrate my point. Let β represent the occupational supply elasticity of US nationals to science and engineering, and γ represent the demand elasticity for scientists and engineers. Increases in the availability of foreign talent or changes in the H-1B visa cap can be thought of as exogenous shifts in the supply of foreign-born workers in the US science and technology sector. An exogenous positive shock to the size of the science and engineering workforce in the United States will work to lower wages of scientists and engineers in the United States and, as a result, fewer US nationals will choose these occupations:

$$d\ln(\text{S\&E earnings}) = 1/[\beta + \gamma] \cdot \text{exogenous supply shock}$$

$$d\ln(\text{S\&E employment US nationals}) = \beta/[\beta + \gamma] \cdot \text{exogenous supply shock}.$$

As long as demand curves are downward sloping (finite γ), an exogenous influx of foreign-born scientists and engineers will work to lower wages and employment of US residents in these occupations. How much of the shock will be felt in terms of wages and how much in terms of employment will depend on how elastic the supply of US residents is to these occupations. Although each additional foreign scientist or engineer "crowds out" $\beta/[\beta + \gamma]$ US-born workers from such occupations, the total employment of scientists and engineers working in the United States will grow by a factor of $\gamma/[\beta + \gamma]$.

What do we know about these supply and demand elasticities? Researchers have consistently found that STEM occupational supply elasticities are

high (Freeman 1975, 1976; Ryoo and Rosen 2004; Bound et al. 2015). Without some large exogenous supply shift, demand elasticities are harder to gauge, but some evidence indicates that the demand elasticity of STEM workers might be quite high—and trade and endogenous technical change tend to increase demand elasticities. High demand elasticities would imply little crowd-out effect from foreign-born STEM hires.

Some researchers (e.g., Kerr and Lincoln 2010) have used geographic variation in the employment of scientists and engineers on H-1B visas within the United States to directly estimate crowd-out. However, if location is endogenous, such efforts will tend to underestimate crowd-out. Khanna, Morales, and I have worked with calibrated general equilibrium models for workers in the computer science (CS) sector that allow for endogenous technical progress (Bound, Khanna, and Morales 2018). Our calculations produce downward-sloped demand curves, showing that the addition of one foreign-born computer scientist to the CS labor market is associated with an occupational switch out of CS by between 0.33 and 0.61 native computer scientist.

The bottom line: although downward-sloping demand curves indicate crowd-out of native-born by foreign-born workers, a crowd-out effect of around 0.5 suggests that highly skilled immigrants have also significantly increased the size of the STEM workforce in the US economy. The claim that US employers of STEM labor cannot find enough adequately skilled workers within the United States appears to be exaggerated. However, at the same time, it seems very likely that the existence of a pool of skilled foreigners has facilitated the growth of the science and technology sector in the United States.

In addition, the reservoir of foreign talent may act as a buffer, smoothing demand adjustments in the US labor market. One can find suggestions of this kind of effect in Hanson and Slaughter's chapter and in comparisons between how the IT labor market responded to IT booms in the late 1970s and early 1980s versus the boom in the 1990s (Bound et al. 2013).

The simple partial equilibrium model used above, together with most of the literature evaluating the impact of high-skilled immigration on the US economy, do not account for any global effects of US immigration policy—which have likely been significant. As pointed out in the theoretical literature, the US preeminence in advanced technologies benefits the US population (Krugman 1979; Johnson and Stafford 1993; Samuelson 2004). Freeman (2006) has argued that US policies on high-skilled immigration have helped the United States maintain technological leadership in the world. However, he ignores the effects this immigration policy might have had on other countries. The possibility of emigrating to the United States raises the returns to education in technical fields in immigrant-sending countries such as India and China. In addition, many foreign-born STEM workers in the United States eventually emigrate elsewhere, taking their acquired job skills with

them. Indeed, Lowell (2000) calculated that roughly half of H-1B visa holders arriving in the United States during the 1990s eventually emigrated.

Both of these potential effects—an increase in returns to STEM education outside the United States and an increase in high-skilled emigration from the United States—imply that US immigration policies allowing foreign-born workers to fill STEM jobs will spur the size and quality of the STEM workforce in sending countries. Khanna and Morales (2017) have tried to quantify these effects, focusing on immigration of computer science workers into the United States from India. Within the context of their model, they find that the H-1B program has indeed spurred CS sector growth in both the United States and in India.

The kind of descriptive evidence that Hanson and Slaughter present in their chapter is important. However, if we are to understand the impact that US policy on high-skilled immigration has had on US workers, consumers, and employers, we need to implicitly or explicitly evaluate counterfactuals. Doing so will require the building and calibration of credible general equilibrium economic models.

A Plea for Data

Hanson and Slaughter end their chapter with a discussion of the need for data to evaluate the impact of high-skilled foreign labor on the US economy. They write: "Relaxing . . . data constraints is essential for the informed study of how high-skilled immigration affects US economic outcomes, including the pace of productivity growth, the earnings premium commanded by highly skilled labor, and differential wage and employment growth across local labor markets in the United States." What I want to emphasize is that, at least in theory, the kind of data that Hanson and Slaughter are talking about exists. Post-9/11 changes in immigration policy should have made tracking immigrants technically possible. What is more, in theory this data could be linked to either Social Security earnings histories or data from the Covered Employment and Wages Program. However, the government has not done these linkages, nor have they given access to this data to researchers. As Hanson and Slaughter emphasize, such data would give us a much more complete picture of the impact that high-skilled immigrants are having on the US economy.

References

Bound, John, Breno Braga, Joseph M. Golden, and Gaurav Khanna. 2015. "Recruitment of Foreigners in the Market for Computer Scientists in the US." *Journal of Labor Economics* 33 (S1): S187–223.

Bound, John, Breno Braga, Joseph M. Golden, and Sarah Turner. 2013. "Pathways to Adjustment: The Case of Information Technology Workers." *American Economic Review, Papers and Proceedings* 103 (3): 203–7.

Bound, John, Gaurav Khanna, and Nicolas Morales. 2018. "Understanding the Economic Impact of the H-1B Program on the United States." In *High-Skilled Migration to the United States and Its Economic Consequences*, edited by Gordon H. Hanson, William R. Kerr, and Sarah Turner, 109–75. Chicago: University of Chicago Press.

Freeman, Richard B. 1975. "Supply and Salary Adjustments to the Changing Science Manpower Market: Physics, 1948–1973." *American Economic Review* 65 (1): 27–39.

———. 1976. "A Cobweb Model of the Supply and Starting Salary of New Engineers." *Industrial and Labor Relations Review* 29 (2): 236–48.

———. 2006. "Does Globalization of the Scientific/Engineering Workforce Threaten U.S. Economic Leadership?" In *Innovation Policy and the Economy*, vol. 6, edited by Adam B. Jaffe, Josh Lerner, and Scott Stern. Cambridge, MA: MIT Press.

Johnson, George E., and Frank P. Stafford. 1993. "International Competition and Real Wages." *American Economic Review* 83 (2): 127–30.

Kerr, William, and William Lincoln. 2010. "The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention." *Journal of Labor Economics* 28 (3): 473–508.

Khanna, Gaurav, and Nicolas Morales. 2017. "The IT Boom and Other Unintended Consequences of Chasing the American Dream." Working paper no. 460, Center for Global Development. https://www.cgdev.org/publication/it-boom-and-other-unintended-consequences-chasing-american-dream.

Krugman, Paul. 1979. "A Model of Innovation, Technology Transfer, and the World Distribution of Income." *Journal of Political Economy* 87 (2): 253–66.

Lowell, B. Lindsay. 2000. "H-1B Temporary Workers: Estimating the Population." Working paper no. 12, University of California, San Diego.

Ryoo, Jaewoo, and Sherwin Rosen. 2004. "The Engineering Labor Market." *Journal of Political Economy* 112 (S1): S110–40.

Samuelson, Paul A. 2004. "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization." *Journal of Economic Perspectives* 18 (3): 135–46.

US General Accounting Office. 2011. "H-1B Visa Program: Reforms Are Needed to Minimize the Risks and Costs of Current Program." Technical Report GAO/HEHS 00-157, US General Accounting Office, Washington, DC.