

The Economic Impacts of Immigration and International Students

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1. Introduction

For the past 20 years, economists have sought to assess the characteristics of immigration as well as the costs and benefits conferred by immigrants upon a wide variety of agents. This paper reviews the immigration economics literature and seeks to understand the evidence that has been used to answer the following question: “what are the innovative, entrepreneurial, and other economic impacts of immigrants and international students?” Previous work (Brown et al., 2019) has classified the literature on the economic impacts of immigrants as proceeding along three primary tracks: (1) consequences for native workers, (2) difficulties faced by immigrants (e.g. assimilation), and (3) advantages enjoyed by immigrants with regard to innovation, invention, and entrepreneurship. This is a useful, if simple framework through which we can classify the literature. However, it is clear that value can be added by clarifying three facets of the literature.

First, while the literature chiefly broadly discusses the effects of immigration on a destination country, authors focus on many agents within that country, and they make little effort to reconcile those differences. For example, authors that assess the innovative activity of firms founded by foreign-born entrepreneurs usually take the *firm* as the agent. These authors evaluate the product/process innovation or economic success of the firm. Others instead focus on the wages provided to *native workers* by

firms owned by foreign-born entrepreneurs. Still others have written about the benefits of immigration to the *immigrants* themselves or the *U.S. economy* as a whole. In this literature review, I attempt to clearly distinguish between these different research directions.

Second, the literature has thus far made little effort to clearly reconcile the different kinds of costs or benefits that immigration imparts upon the agent. In this literature review, I consider the following types of gains and losses:

- Wage changes,
- Creating positions vs. crowding-out native workers/students,
- Entrepreneurial activity,
- Innovative activity,
- Knowledge flows,
- Scientific success,
- Economic growth,
- Economic dynamism.

Since my interest is primarily in the impacts of immigration on the United States economy and U.S. agents, I ignore two features of immigration that are the focus of the European immigration economics literature: how immigrants assimilate to their new employment and how immigrants use social benefits (Kerr and Kerr, 2011).

Furthermore, unless stated otherwise, the papers reviewed below are focused on the United States as the destination country for immigrants and international students.

Third, the literature does not offer a consistent definition of an “immigrant,” which obscures the research implications. The most consistent definition of “immigrant” in the

economics literature seems to refer to any individual who is foreign-born. This definition is misleading because (in most cases) it aggregates three distinct sub-groups: permanent residents (non-citizen), naturalized citizens, and non-immigrant migrants (e.g. H-1B visa recipients). These sub-categories of “immigrants” are sufficiently different that they should be analyzed separately. For example, I hypothesize that naturalized citizens behave differently in some respects from H-1B visa holders. At the very least, authors who choose not to unpack “foreign-born” should clearly state their implicit assumption that different categories of foreign-born individuals behave similarly. Despite these important distinctions, the authors whose work I reviewed consistently offered “foreign-born” as their definition of “immigrant” (e.g. Hansom and Liu, 2018; Kerr and Kerr, 2016; Waugh, 2018; Brown et al., 2019; Azouley et al., 2020).

Two additional distinctions could be made more clearly. Authors should clearly differentiate research that explores slow, continuous migration from research that analyzes a one-time shock (e.g. an ethnic diaspora). Authors should also take care to distinguish work on high-skill immigration from work on low-skill immigration.

Similarly, some papers in the international students literature dangerously equate Master’s students and PhD students by exploring “graduate students” in aggregate. Master’s and PhD students are substantially different in most cases and should not be aggregated. In this literature review, I take care to clearly distinguish between different types of immigrants and students, to the greatest degree possible.

My review is divided into three sections. In chapter 2, I assess the literature on immigrants and non-immigrant migrants. Then, in chapter 3, I pivot to a population of non-immigrant migrants who could become immigrants: international students. These

two chapters attempt to fairly present the evidence without excessive injection of my own biases. Finally, in chapter 4, I lay out a few directions for future research as well as barriers to future research, which, if lifted, would greatly widen avenues for future work.

2. Immigrants and Non-immigrant Migrants

In 1988, George Borjas created the literature on immigrant self-selection.

Self-selection is the idea that potential emigrants from a country will choose a destination country by comparing their options. While this principle is simple, it is also foundational to understanding how immigrants choose their destination country. In his 1988 work, Borjas attempted to model the decision-making process of an emigrant deciding where to immigrate. For many high-skilled emigrants, the United States is an attractive destination, perhaps even the most attractive destination. The high demand for immigration to the United States has led U.S. policymakers to grapple with the costs and benefits that immigrants and non-immigrant migrations impart on U.S. firms and workers, as well as on the U.S. economy as a whole. This literature review will only focus on the economic, innovative, and entrepreneurial implications of immigration, as discussed in the introductory chapter.

There are two primary costs and two primary benefits associated with high-skilled immigration (Khanna and Lee, 2018). First the costs: immigrants can theoretically crowd-out native workers, increasing unemployment for native workers. Immigrants, when they increase the size of the labor pool, can also lower the wages of native workers who are close substitutes to the immigrants. Next the benefits: immigrants could increase the profits and innovative capacity of the firms where they are employed. Immigration could also increase the wages of native workers.

2.1 Innovation and Knowledge Creation

Authors seem to disagree about how to properly measure innovation. Most authors use patenting as a measure of innovation (e.g. Hunt and Gauthier-Loiselle, 2008), while others see patenting as a proxy for *invention* instead (e.g. Moser et al., 2014). Since there does not appear to be a clear consensus on the matter, I subjectively chose to classify patenting as a proxy for *innovation*, but I indicate where authors labeled it instead as a measure of invention.

An expansive 2008 paper provides one of the earlier evaluations of how high-skill immigration impacts innovation (Hunt and Gauthier-Loiselle, 2008). The paper extended the literature using an individual-level analysis to show the impact of immigration on U.S. innovation. The authors found that a 1% increase in the number of foreign-born individuals with a college degree increases patents per capita by 6% in the population of college graduates living in the U.S. Since 2008, many others have attempted to similarly explore the impact of immigration on innovation using patenting as a measure of innovation or invention.

Moser et al.'s 2014 piece on German Jewish emigres applies a historical perspective to the link that connects immigration and innovation (or “invention,” in the case of this paper). The authors found that the 1933-1941 emigration of German Jewish chemists to the U.S. encouraged innovation among native U.S. chemists. Most notably, the authors found that the immigrants encouraged innovation by attracting new researchers to the field, not by increasing the productivity of incumbent researchers.

A recent 2020 paper (Doran and Yoon, 2020) also adopted a historical approach to immigration and innovation, finding that European immigration quotas implemented

by the U.S. government in the 1920s reduced innovation (also redefined by the authors as “invention”). Specifically, the authors found that a 10% reduction in immigration reduced patents by 0.5% per year. Unlike the Moser et al. paper, however, this finding applies specifically to low-skill immigrants. These two papers show (historically, at least) that immigrants across the skill distribution have positively benefited U.S. innovation.

In the late 20th and early 21st century, immigrants and non-immigrant migrants still seem to increase U.S. innovation. Burchardi (2020) found that migration increased patenting by local firms. Interestingly, but perhaps not surprisingly, Burchardi also found that the effect grew for migrants who were more highly-skilled. Khanna and Lee (2018) found that firms that hired non-immigrant migrants (indicated by H-1B certification) were associated with higher amounts of product reallocation, which is one measure of innovation. In summation, it seems that not only did immigrants and non-immigrants historically increase U.S. innovation but that they continue to do so today.

A review of global talent flows (Kerr et al., 2016) found that the literature supports the notion that high-skill immigration increases U.S. innovation and productivity; to Kerr et al., the papers that reported a null effect were less convincing, on aggregate, than those that found a positive effect. Relying on the papers introduced in this subsection, immigration appears to have a positive effect on aggregate U.S. innovation and productivity, gains which disproportionately benefit firms founded by foreign-born entrepreneurs (Brown et al., 2019) as we see in the following section.

2.2 Entrepreneurship

Immigration has many implications for firms (Waugh, 2018) founded by foreign-born entrepreneurs. The literature seeks to answer a few key questions about

these firms. First, are immigrants more or less likely to engage in entrepreneurial activity? In other words, are foreign-born individuals more or less likely to found a firm compared to their native counterparts? Second, are firms founded by foreign-born entrepreneurs more or less innovative? Finally, do firms founded by foreign-born entrepreneurs create comparable numbers of jobs compared to native-founded firms, and how well do firms founded by foreign-born entrepreneurs pay their workers?

There is some evidence that foreign-born entrepreneurs possess networks and knowledge that gives them a competitive advantage over their native competitors. A qualitative study of three Canadian firms, for example, found that the foreign-born founders of these firms were able to more easily internationalize because of their knowledge of international markets and strong networks in other countries (Vissak and Zhang, 2014). A study of the Cambridge Innovation Center (CIC) found that foreign-born entrepreneurs were more likely to utilize CIC services and provide services to other CIC members compared to their native counterparts, which could indicate that foreign-born entrepreneurs are more proactive networkers (Kerr and Kerr, 2019).

Foreign-born entrepreneurs appear to be more likely to start a company than their native counterparts. Azoulay et al. (2020) observed this phenomenon not just on aggregate, but they also found that foreign-born entrepreneurs were more likely to start a company at each firm size. Azoulay et al.'s work echoes the findings of a 2016 paper (Kerr and Kerr, 2016) which similarly found that foreign-born entrepreneurs start companies at higher rates than their native counterparts. Kerr and Kerr also found that the firms started by foreign-born entrepreneurs performed better than firms started by native entrepreneurs.

Firms that were founded by foreign-born entrepreneurs appear to exhibit higher degrees of innovative activity and perform better than native founded firms. A recent paper (Brown et al., 2019) measured 16 indicators of innovation for a sample of firms in high-tech industries. The authors found that innovation was higher in 15 out of 16 indicators for firms that were founded by foreign-born entrepreneurs. The authors found that this correlation was not affected by firm age or the education level of the entrepreneur. This supplements the findings presented in the previous section, which spoke to the innovative activity of foreign-born individuals (not entrepreneurs). Not only are foreign-born individuals more innovative on their own, but they also seem to found companies that are more innovative, at least in high-tech industries. Furthermore, Khanna and Lee (2018) found that foreign firms with H-1B certification had, on average, higher revenue growth than native firms without H-1B certification.

Firms that were founded by foreign-born entrepreneurs appear to create fewer jobs and offer fewer benefits, on average, compared to native founded firms (Kerr and Kerr, 2020). The data from this study are fairly recent; they came from surveys in 2007 and 2012. These findings indicate that even while foreign-born entrepreneurs seem to start firms more frequently than their native counterparts, those firms might present fewer and less desirable opportunities to native workers. However, this does not seem to be the case for the wages supplied by foreign-born founded companies.

Firms that were founded by foreign-born entrepreneurs appear to offer similar wages to their workers compared to native founded firms. This finding is consistent across a few studies (Kerr and Kerr, 2020; Azoulay et al., 2020). All told, foreign-born entrepreneurs seem to act more as “job creators” than as “job takers” (Azoulay et al.,

2020). In other words, the jobs added by firms that were founded by foreign-born entrepreneurs are greater than the jobs occupied by foreign-born individuals. In the next section, I will focus in part on why this finding is so interesting; it refutes persistent concerns that immigrants are crowding-out domestic workers.

2.3 Wages and Crowding-out

Both of the key arguments for how immigration can create economic costs, which I introduced at the beginning of the chapter, apply to the wages and employment opportunities for native workers. Specifically, immigrants can theoretically crowd-out native workers, leading to higher unemployment of native workers. Immigrants can also lower the wages of native workers who are close substitutes to the immigrants. The primary purpose of this section is to assess the validity of the crowding-out argument and determine to what extent (or under which conditions) it is validated by empirical evidence. However, native workers are only one of two important agents: we must also consider the wages and employment opportunities of the foreign-born individuals themselves.

Recent migrants are likely to experience lower wages compared to their native counterparts, but as the duration of their stay increases, their wages will partially converge towards native levels. These findings were consistently observed across European countries and reported in a 2011 literature review (Kerr and Kerr, 2011). It is unclear if these findings hold true for migrants to the United States as well.

Scientists who are foreign-born (and foreign-trained) do not seem to crowd out their native counterparts in the United States. This comes from a 2019 study (Agrawal,

2019) of star scientists.¹ The findings of this study are further constrained by field; the study only assessed star scientists in a subset of science, engineering, and social science fields. As a result, while the findings are interesting, it is unclear to what extent they can be generalized to a broader set of fields or to scientists representing a wider skill distribution. Agrawal's work builds off a slightly older paper that presented more generalized evidence on the comparative (dis)advantage of high-skilled foreign-born workers.

A 2018 study looked at the comparative advantage of high-skilled native U.S. workers over high-skilled foreign-born workers from a variety of regions (Hanson and Liu, 2018). The authors found that high-skilled native workers have a comparative advantage over their counterparts from Latin American countries, but native workers were at a comparative disadvantage relative to foreign-born workers from India and China. This could indicate that high-skilled immigrants from India and China are crowding-out native U.S. workers.

In conclusion, it seems that while foreign-born star scientists probably do not crowd-out native U.S. star scientists, that is not necessarily true for a wider distribution of high-skill workers. Foreign-born workers from India and China may crowd-out some of their high-skill counterparts in the U.S.

2.4 Growth and Inequality

A recent paper attempts to model the impact of immigration on the growth of average incomes in an economy (Borjas, 2019). Borjas models output per capita using a standard Solow model. He argues that a one-time immigration shock, acting as an

¹ Star scientists are the scholars at the very peak of the skill distribution; they are often identified through high citation scores.

increase to the rate of population growth in the model, would decrease output per capita in the short-run but not in the long run. However, he argues that a continuous migration, modeled as a permanent increase to the population growth rate would slow the growth rate of output per capita in the long-run. While this is an interesting paper, it does little more than to further solidify a previously-established theoretical framework. If this model were validated using U.S. immigration data, Borjas's argument would be more compelling. As it stands, this is an interesting direction of research, but it currently provides few answers on the impact of immigration on U.S. aggregate economic growth.

A different (more compelling) paper found that immigration has actually led to a narrowing of economic inequality (Jaimovich and Siu, 2018). The authors looked at data for high-skill foreign-born workers in STEM fields from 1980-2010, which they used to model the impact of immigration on technological change, employment polarization, and wage inequality; they found that immigration significantly reduced wage inequality. This finding presents a little-explored but potentially powerful benefit of immigration to the U.S. economy.

2.5 Knowledge Flows

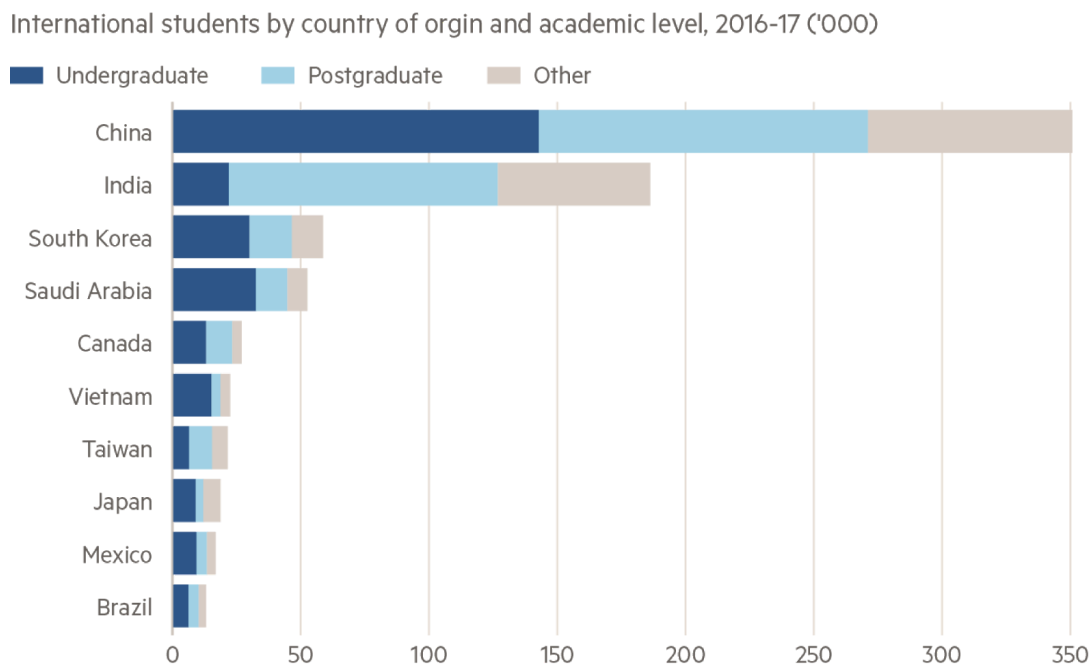
Finally, to round out the chapter, I will briefly discuss recent work that seeks to understand how knowledge flows through diaspora networks. The purpose of this vein of research is to understand the potential benefit (to the *origin* country) of immigrants that acquire knowledge abroad and transmit it back home through a diaspora network. Agrawal (2017) developed a model for this phenomenon and found that the economic benefits to India of a diaspora network due to return knowledge flows do not outweigh

the human capital losses. This finding can be conceptualized by network theory and understood as (partially) a consequence of information stickiness (von Hippel, 1994).

Agrawal also notes a major shift in the knowledge flow literature (Agrawal, 2017): scholars are increasingly focusing on social distance, which can be understood with network theory, instead of physical distance as a determinant of knowledge flow patterns.

3. International Students

Figure 1: China is the biggest source of international students for the U.S.



Source: Institute of International Education via Financial Times (Sevastopulo, 2018)

U.S. universities welcomed 1.1 million international students in the 2018-19 school year—the majority of which came from China (see Figure 1). International students make important financial contributions to the U.S. economy. Data from

NAFSA: Association of International Educators suggests that international students in the U.S. contributed \$41 billion to the U.S. economy in the 2018-19 academic year alone (Morgan and Kasey, 2019). The purpose of this chapter is to assess the economic benefits and costs of international students for some of the agents that we discussed in chapter 2: native workers, the U.S. economy as a whole, and international students themselves. This chapter focuses primarily on graduate students—PhD students, in particular—because the literature on the costs and benefits of international students is heavily skewed towards those students.

3.1 Brain Circulation

Over the past 20 years, millions of Chinese and Indian students were educated at American universities, raising concerns about “brain drain” in those countries. “Brain drain” describes the phenomenon where students in a developing country study abroad in a developed country (e.g. the United States) and then choose to live there, often permanently, which deprives their origin country of high-skilled human capital. A “brain drain” for China could become a “brain *gain*” for the United States, since the U.S. gains much of the human capital lost by China. However, researchers have also presented the notion that “brain drain” might not accurately describe the migration patterns of international students. Instead, perhaps international students return more frequently to their country of origin after receiving their degree; this is known as “brain circulation.”

The extent to which China and India are experiencing brain circulation instead of brain drain could have serious implications for the United States economy. For example, if China and India are increasingly experiencing brain circulation as their economies continue to rapidly develop, then the United States would begin to lose out on greater

numbers of talented students who decide not to join the U.S. workforce. Both India and China are attempting to facilitate brain circulation by funding returnee programs that recruit young talent (Tung, 2008; Fedasiuk and Feldgoise, 2020). However, despite recruitment efforts, a 2006 study from the Brookings Institution found that international students decide to study in the United States primarily to attain skills that they could then use in the U.S. workforce (Rosenzweig et al., 2006). If brain circulation is emerging, then it has likely done so only in recent years.

We do not see evidence supporting brain circulation in recent years. A 2014 study found that foreign-born individuals who pursued a degree at a U.S. school were more likely to remain in the U.S. compared to other foreign-born individuals (Turner et al., 2014). While this study does not directly address concern about brain circulation, the finding is inconsistent with what we would expect to see if brain circulation were occurring at high rates.

A second study shows that intention-to-stay rates among international PhD students in STEM fields have remained high through 2017 (Zwetsloot et al., 2020). This finding was robust across each of the STEM fields tracked by the data. If brain circulation is increasingly prevalent, then we would expect to see declining intention-to-stay rates in recent years, which we do not. However, this study does not speak to international undergraduate and Master's students who could be participating in brain circulation at higher rates than PhD students. Unfortunately, researchers don't seem to have a robust, empirical method to estimate stay rate trends for undergraduates and Master's students.

3.2 Knowledge Creation and Entrepreneurship

International PhD students contribute significantly to knowledge production at their universities, but it is unclear whether international PhD students produce significantly more knowledge than their American counterparts. A 2012 analysis (Stuenkel et al., 2012) of data from 1973-1998 found that both international and American PhD students contribute significantly to the scientific productivity of science and engineering departments. However, on the question of the relative knowledge productivity of international students, a 2013 study found that international and American PhD students create knowledge at statistically indistinguishable rates (Maskins et al., 2013).

International PhDs appear to be significantly less likely to found a company or work for a startup for their first post-graduate job compared to their American counterparts (Roach et al., 2019). This was the case even though international PhDs reported being more interested, on average, in founding or working for a startup compared to their American counterparts. This indicates that PhD students in the U.S. are facing barriers to postgraduate entrepreneurship, perhaps due to restrictive visa policies.

3.3 Crowding-out

At all levels of enrollment, international students seem to subsidize native students instead of crowding them out. An analysis of the United Kingdom's higher education system found no evidence that undergraduate international students crowded-out their domestic counterparts (Machin and Murphy, 2015). A 2017 study of graduate students in the U.S. found that international students increased enrollment of native students, primarily by subsidizing the cost for U.S. universities to enroll additional

American students (Shih, 2017). While the study's aggregation of Master's and PhD students into "graduate students" erases key distinctions, the overall finding is still useful.

4. Discussion

In this section, I briefly outline directions for fruitful future research as well as current research barriers, which, if lifted, would open doors to new avenues for additionally rigorous research.

As discussed in chapter three, there is a gap in the literature on the economic impacts of international students; specifically, little academic, peer-reviewed work has sought to understand the economic impacts of international undergraduate students. Authors choose to instead research graduate students (a combination Master's and PhD students) or international students as a singular block. While graduate students certainly more likely produce new knowledge that leads to innovative activity, it is still important to understand to what extent undergraduate students benefit or harm the U.S. economy through innovative activity, entrepreneurship, and financial contributions. Furthermore, understanding the costs and benefits of international undergraduate students is a large area for concern for U.S. government policymakers who seek to understand the national security implications of foreign undergraduates. This research area is severely underpopulated, and if filled, could greatly influence U.S. government policymaking.

Two types of currently uncollected data would improve the robustness of the immigration economics literature and create new opportunities for research. The first barrier is the lack of skill-level data for individual immigrants and foreign students. When

it's necessary to control for the skill of immigrants, the research presented in this paper looks to proxies—the average income for each industry or origin-country wages, for example—to estimate those skill differences. An individual-level skill assessment included in the USCIS's immigration records, for example, would help improve the robustness of immigration research. A skill classification of this sort would also open new avenues for research into the differences between high and low-skill immigrants.

The second barrier is a lack of broadly-collected stay rate data, both for international students and immigrants more generally. Intention-to-stay rate data is collected by the National Science Foundation (NSF) as part of its census of PhD students (Survey of Earned Doctorates). In addition, the NSF's Survey of Doctorate Recipients tracks the physical locations of a small percentage of PhD students using a fixed panel survey design, but unfortunately, these data appear to be the only good data on international student stay rates; no administrative data are collected on undergraduate and Master's students. Furthermore, few data seem to be available on the stay rates of non-immigrant migrants to the United States (e.g. H-1B visa recipients). Researchers could more thoroughly explore the propensity for international students and non-immigrant migrants to remain in the U.S. if these administrative data were expanded in scope.

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