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# A Canada–U.S. Comparison of the Economic Outcomes of STEM Immigrants

by Garnett Picot and Feng Hou

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# A Canada–U.S. Comparison of the Economic Outcomes of STEM Immigrants

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# Abstract

In both Canada and the United States, immigrants constitute a disproportionately large share of the supply of university-educated labour trained in the science, technology, engineering and mathematics (STEM) fields. This article examines the Canada–U.S. differences in the occupational skill utilization and earnings of STEM-educated immigrant workers. Using data from the 2016 Census for Canada and the combined 2015 to 2017 American Community Survey, this analysis focuses on immigrants with a university degree in a STEM field who were aged 25 to 64 and arrived as adults. Over one-half of STEM-educated immigrant workers in both countries held non-STEM jobs. In Canada, only about 20% of these immigrants with non-STEM jobs worked in occupations that required a university education, compared with 48% in the United States. There was a large earnings gap between STEM-educated immigrants and native-born workers in Canada, even after adjusting for sociodemographic differences, while no corresponding earnings gap existed in the United States. The earnings gap in Canada was particularly large for STEM-educated immigrants holding non-STEM jobs. Possible explanations for these results are discussed.

# Executive summary

Skills in the science, technology, engineering and mathematics (STEM) fields are increasingly regarded as essential to innovation, productivity growth and competitiveness. In both Canada and the United States, immigrants provide a very large share of the STEM-educated labour and hold a large share of STEM jobs. Furthermore, the selection system for economic immigrants, including the STEM educated, varies significantly between Canada and the United States and likely affects the economic outcomes of immigrants. For these reasons, a Canada–U.S. comparison of the outcomes of STEM-educated immigrants is important. Using data from the 2016 Census for Canada and the 2015 to 2017 American Community Survey for the United States, this paper examines the differences between the two countries in the occupational and earnings outcomes of STEM-educated immigrants. The analysis is restricted to STEM-educated immigrant workers aged 25 to 64 who held at least a bachelor's degree and were adults upon entry.

In both Canada and the United States, adult immigrants with at least a bachelor's degree were twice as likely as their native-born counterparts to have studied in a STEM field and three times as likely to have studied engineering or computer science and mathematics.

Just as among Canadian-born individuals, over one-half of STEM-educated immigrant workers in both countries held non-STEM jobs. Only 20% of these immigrants in Canada found a job requiring a university degree, while the situation was better in the United States, at 48%.

For all STEM-educated workers, immigrants earned 26% less than their native-born counterparts in Canada, even after adjusting for differences in sociodemographic characteristics. There was no earnings gap between immigrants and native-born individuals among STEM-educated workers in the United States. Furthermore, differences in the characteristics of STEM-educated immigrants and their native-born counterparts explained very little of the large earnings gap in Canada. In the United States, there was not much of a gap to explain.

Even STEM-educated immigrants with STEM jobs earned significantly less than the native-born population (17% less, adjusted for sociodemographic characteristics) in Canada, while in the United States they earned 4% more than their native-born counterparts.

The adjusted earnings gap for those who did not find a STEM job was large in Canada, at 34%. The gap was much smaller in the United States (7%). In Canada, the issue regarding the skill utilization of STEM-educated immigrants was more pronounced among the more than one-half who did not find a STEM job.

There are a number of possible reasons to explain the Canada–U.S. differences in the outcomes of STEM-educated immigrants, including the possible preference of higher ability STEM-educated immigrants for the United States over other countries, the greater relative supply of STEM-educated immigrants in Canada than in the United States, differences in the method of selection of highly skilled economic immigrants and possible differences in the country of education of STEM-educated immigrants. Regarding the last point, research has shown that country of education is one of the most important determinants of the economic outcomes of highly skilled immigrants.

# 1 Introduction

Skills in the science, technology, engineering and mathematics (STEM) fields are increasingly regarded as essential to innovation, productivity growth and competitiveness (Council of Canadian Academies 2016). Immigrants in both Canada and the United States are a key source of supply of individuals with STEM skills. For example, immigrants held 42% of the STEM jobs among workers with at least a bachelor's degree in a STEM field in Canada in 2016, and 30% in the United States over the 2015-to-2017 period. These shares are much higher than immigrants' share in the total population, which is about 22% in Canada and 14% in the United States. In some STEM occupations, immigrant shares were particularly high. For example, among STEM jobs occupied by doctoral graduates in engineering, 72% were filled by immigrants in Canada and 60% in the United States.

Given immigrants' role in providing STEM skills, knowledge of their outcomes is essential in both countries. Few previous studies have compared the labour market outcomes of STEM-educated immigrants in Canada and the United States directly. The one exception is Clarke, Ferrer and Skuterud (2019). Using data up to 2010, they found that the relative earnings of STEM-educated immigrants in the United States and Australia were superior to those of their counterparts in Canada. This article builds on earlier work by using a broader range of outcome variables with more recent data, and by making cross-country comparisons by field of study and degree level. It examines Canada–U.S. differences in the occupational skill utilization and earnings of immigrants with at least a bachelor's degree in a STEM field, and discusses possible explanations for the observed differences.

A comparison of the two countries is useful because they have different immigration policies and methods of selecting highly skilled immigrants (Lu and Hou 2020; Bonikowska, Hou and Picot 2011). The Canadian immigration system emphasizes economic immigration, while the U.S. system is oriented toward family reunification (American Immigration Council 2019; Lu and Hou 2020). Recently in Canada, roughly 60% of new immigrants were economic immigrants, and 25% to 30% were family immigrants.[1] In the United States, typically almost two-thirds entered under family reunification provisions, and roughly 13% to 15% entered under employment-based provisions. The remainder entered as asylum seekers or refugees (American Immigration Council 2019).

Specific to the focus of this study, the selection processes of highly educated STEM immigrants also differ between Canada and the United States. Canada uses a points-based system for economic immigrants that has been in place since 1967. Principal applicants in the economic class receive points for educational attainment, age, work experience, language skills and other attributes. As a result, a very high percentage (roughly two-thirds) of economic immigrants have a university degree (Hou and Picot 2016). Traditionally, employers played virtually no role in selecting immigrants via the points system. However, more recently they have started to play a greater role through the selection of immigrants by the provinces and because many economic immigrants are now selected among temporary foreign workers. These former temporary foreign workers are selected by employers (Hou, Crossman and Picot 2020a).

In the United States, many highly skilled (notably STEM-educated) immigrants are selected initially by employers through the H-1B or other temporary visa programs. Many go on to become permanent residents. Others enter as international students, then seek employment following graduation. Employers play a significant role in this case. Lastly, some enter through the employment-based immigration selection system, most with employers as sponsors. As a result,

1. The annual inflows of immigrants increased from 227,000 in 2000 to 321,000 in 2018. Among economic immigrants, about 40% to 47% were principal applicants who were evaluated by the points system, and the remaining 53% to 60% were their spouses and dependants.

the selection of highly skilled economic immigrants has been related more directly to the preferences of the employers and immediate needs of the labour market (through employer selection) in the United States than in Canada.

Furthermore, the per capita intake of highly educated economic immigrants has been much lower in the United States than in Canada, both because the overall immigration rate is lower in the United States than in Canada[2] and because a smaller percentage of the U.S. intake consists of highly skilled economic immigrants, notably STEM-educated immigrants. These differences in immigration policies and selection processes render a comparison of the economic outcomes of STEM-educated immigrants all the more interesting.

This analysis was conducted using data from before the COVID-19 pandemic. The demand for different types of labour and the conditions of work could change post-pandemic, at least in the short run and perhaps also in the long run. Employers that make significant use of technical skills may speed up the movement toward automation. This is typically done for productivity reasons, but concerns about future exposure to viruses may also play a role. STEM employees would play a significant role in the innovation required for such technical advancement. If telework becomes more prevalent, many STEM employees could function well under such conditions. Those involved in technical work often do not interact with the general public. In fact, it has been argued that one of the reasons immigrants concentrate in STEM occupations is because the subtleties of social norms play less of a role in the success of the job than they do in other occupations, such as salespeople and lawyers. In short, STEM-educated individuals are not likely to be at a disadvantage relative to others in a post-COVID-19 labour market, and they may in fact be in a relatively advantageous position. Any significant changes affecting STEM employees in general—and immigrants in particular—would likely be similar in both Canada and the United States, so they may not affect the relative outcomes.

# 2 Recent research

## 2.1 Canada

There have been only a handful of recent studies on the economic outcomes of immigrant STEM workers in Canada. The Council of Canadian Academies' (CCA) report on STEM skills and economic prosperity suggested that there was no general supply–demand imbalance in STEM skills in the Canadian labour market (CCA 2016). The CCA report showed that the majority of STEM-educated workers worked in non-STEM fields. This held for both immigrants and the Canadian-born population, but this was not seen as an issue. The report argued that STEM skills were relevant and useful in many types of jobs and could—therefore—open other doors for STEM-educated workers. While this may be true for immigrants educated in developed countries, whether it holds for those educated in developing countries is questionable. The report also showed that immigrant university graduates were much more likely to be educated in a STEM field than Canadian-born graduates, but immigrant STEM graduates had higher unemployment and lower employment rates than their Canadian-born counterparts.

Other recent papers have also examined the economic outcomes of STEM-educated immigrants. Boyd and Tian (2017) showed that STEM-educated immigrants were less likely to work in a STEM occupation than their Canadian-born counterparts. This difference was associated with the language ability of immigrants and the fact that they were more likely to have received their degrees outside Canada. In a follow-up paper, Boyd and Tian (2018) found that the detailed

2. Documented immigrants entering the United States annually constitute roughly 0.4% of the population. In Canada, this figure is roughly 0.8%.

country of education of STEM-educated immigrants was an important determinant of both employment in a STEM job and earnings.

Blit, Skuterud and Zhang (2017) found that the probability of a STEM graduate being employed in a STEM occupation increased from 1986 to 2006 for Canadian-born individuals, but fell for immigrants. They argued that the declining share of immigrant STEM graduates working in STEM occupations would limit their ability to contribute to innovation in Canada. Picot and Hou (2018) established that, from 1986 to 2011, the education–occupation match (the share working in STEM jobs and in jobs requiring a university degree) and earnings outcomes deteriorated among immigrant STEM graduates, but remained more or less constant among Canadian-born STEM graduates. Furthermore, the earnings gap between immigrant and Canadian-born STEM graduates did not close quickly with years in Canada. The poor outcomes were particularly evident among the more than one-half of STEM-educated immigrants who did not work in a STEM job. In a follow-up article, Picot and Hou (2019*a*) concluded that STEM-educated immigrants with engineering degrees faced the poorest outcomes among STEM graduates.

## 2.2 United States

Fewer studies have examined the economic outcomes of STEM-educated immigrants in the United States. Landivar (2013) conducted a general review of STEM workers in the United States and determined that only around one-quarter of STEM-educated workers (native-born individuals and immigrants) were employed in STEM occupations. Hanson and Slaughter (2016) observed that there was virtually no average earnings difference between American-born and immigrant workers in STEM occupations. This is different from what was reported for Canada above. Looking at earnings assimilation, Hanson and Slaughter showed that, after entering the United States, STEM-educated immigrant workers in STEM jobs experienced only a very small entry earnings gap with their American-born counterparts (around 6%), and this gap disappeared in about six years, after which they earned more than their American-born counterparts. This result also differed from the patterns observed in Canada.

# 3 Data and methods

## 3.1 Data

The data are from Canada's 2016 Census of Population 25% sample microdata file (Statistics Canada 2017) and the pooled 2015, 2016 and 2017 American Community Survey (ACS) data from the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al. 2017). Three years of ACS data were pooled to increase the sample size of immigrants in the U.S. data. The study samples were restricted to adults aged 25 to 64 with at least a bachelor's degree in a STEM field. The analyses focused on adult immigrants who immigrated at age 18 or older, although the native-born population and childhood immigrants (those who immigrated at an age younger than 18) were included in the descriptive tables, and the native-born population was used for earnings comparisons. The study excluded new immigrants who arrived in the census or survey year because of the different data collection procedures in the ACS and Canadian census.[3] In the earnings analysis, those who arrived in the year prior to the census or survey year were also excluded because they may not have stayed for a whole year.

3. The 2016 Census of Population was conducted on May 10, 2016. New immigrants who arrived after Census Day were not captured. In comparison, the ACS was collected each month. Therefore, it captured immigrants who arrived throughout the survey year.

## 3.2 Measures

### 3.2.1 Classification of STEM fields of education and STEM occupations

For Canada, STEM fields of study are based on Statistics Canada's 2016 Classification of Instructional Programs STEM groups (Statistics Canada n.d.). To be consistent with the U.S. classification, some psychology and economics fields that cannot be identified in the ACS data (e.g., econometrics and quantitative economics) and management sciences and quantitative methods were excluded, while architecture and teacher education in mathematics, science and computer science were included.

For the United States, STEM fields of study include the science and engineering group, and science and engineering related fields in the 2016 ACS field of degree code list (U.S. Census Bureau 2016). To be consistent with the Canadian groupings, this study excluded general agriculture, agricultural production and management, agricultural economics, psychology, social sciences, intercultural and international studies, interdisciplinary social sciences, and general medical and health programs, but added military technologies.

The classification of STEM occupations in Canada was derived from previous Canadian studies (Boyd and Tian 2017; Blit, Skuterud and Zhang 2017; Picot and Hou 2019*a*). To be consistent with the U.S. definition, postsecondary instructors with STEM degrees were classified as working in STEM occupations. The classification of STEM occupations in the United States primarily follows the groupings of STEM and STEM-related occupations listed in a U.S. Census Bureau report (Landivar 2013), which applies the recommendation made by the Standard Occupational Classification (SOC) Committee to the ACS data. To be consistent with the Canadian classification, health care and social sciences occupations were excluded. A similar approach was used in a U.S. Bureau of Labor Statistics report (Vilorio 2014). The present study also added the following STEM-related occupations that are included in the Canadian classification: avionics technicians; electric motor, power tool and related repairers; electrical and electronics installers and repairers, transportation equipment; electrical and electronics repairers, industrial and utility; electronic equipment installers and repairers, motor vehicles; electronic home entertainment equipment installers and repairers; aircraft mechanics and service technicians; industrial and refractory machinery mechanics; aircraft pilots and flight engineers; and air traffic controllers and airfield operations specialists.

### 3.2.2 Outcome variables

This study examines three outcomes.

The first is the proportion of STEM-educated adults with at least a bachelor's degree working in STEM occupations.

The second outcome is the proportion of STEM-educated adults with at least a bachelor's degree working in occupations that require a university degree. The educational requirement for a given occupation is based on the four-digit National Occupational Classification (NOC) developed by Employment and Social Development Canada for about 500 occupational groups. The skill level in the NOC is defined primarily by the amount and type of education and training required to enter and perform the duties of an occupation. Four skill levels are identified in the NOC: Skill Level A, university degree (bachelor's, master's or doctorate); Skill Level B, some postsecondary education (college diploma); Skill Level C, high school graduation or some job-specific training; and Skill Level D, some secondary or elementary education and on-the-job training. The NOC does not assign specific educational levels to management occupations. For the purpose of this study, senior management occupations and specialized middle management occupations were treated as Skill Level A, while middle management occupations in retail, wholesale trade,

customer services, transportation, production and utilities were treated as Skill Level B. The 2016 version of the NOC was used.

The NOC educational requirements were applied to the six-digit SOC codes used in the ACS through a concordance between the six-digit SOC codes and the four-digit 2011 NOC codes (the 2011 NOC has the same structure as the 2016 NOC). This concordance was based on the similarity between the occupational descriptions in the SOC and NOC (see Frenette and Frank [2017] for details). Alternatively, the educational requirements specified in the SOC by the U.S. Bureau of Labor Statistics can be applied to the NOC using the same concordance. A previous study that used both approaches confirmed that the two yield similar results in terms of the cross-country differences in the proportion of university-educated immigrants working in occupations requiring a university education (Lu and Hou 2020).

The third outcome is annual earnings in 2015 constant dollars. In multivariate models, the log transformation was used.

### 3.2.3 Control variables

Several individual-level demographic characteristics were included as control variables in multivariate models for earnings. Variables common to both the native-born population and immigrants are gender (male=0, female=1), age, degree level (bachelor's, master's or professional degree, doctorate), field of study (science and technology, engineering, computer science, mathematics), marital status (married, divorced or separated, widowed, never married), race (White, Black, Latin American, Asian, other)[4] and city size. City size comprises six categories according to population size, i.e., ≤100,000, 100,000 to ≤500,000, 500,000 to ≤1 million, 1 million to ≤5 million, 5 million to ≤10 million, >10 million.

Variables specific to immigrants are language, whether they were educated in a foreign country, years since immigration and source region. Because very few immigrants with a university education in a STEM field reported not speaking an official language, the language spoken at home was used to measure language ability. It was coded as speaking English versus speaking other languages at home in the United States, and primarily speaking English outside Quebec or speaking French in Quebec versus speaking other languages. The country where degree was obtained measures whether an immigrant received their highest degree in the receiving country. For the United States, this variable was derived from age at immigration and years of school (foreign educated if years of schooling plus 6 is less than age at immigration). In the Canadian data, this information is available directly. For both countries, immigrant source regions were classified into 14 categories: North America, Central America, Caribbean, South America, Northern Europe, Western Europe, Southern Europe, Eastern Europe, Africa, South Asia, Southeast Asia, East Asia, West Asia and other.

## 3.3 Methods

In this analysis, the shares of adult immigrants among university-educated adults by field of study and degree level in Canada and the United States were calculated first. These shares show the importance of immigrants in the supply of university-educated labour, particularly in STEM fields. Next, the share of adult immigrants, childhood immigrants and native-born individuals in STEM fields among individuals with a university degree was calculated. These statistics show the

4. Racial grouping in Canada is based on responses to the Canadian census question on visible minority membership: "Is this person: White, Chinese, South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.), Black, Filipino, Latin American, Arab, Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.), West Asian (e.g., Iranian, Afghan, etc.), Korean, Japanese or Other—please specify?" White includes those who self-identified as White only and excludes individuals who self-reported as both White and one or more minority groups. Racial groups were similarly defined for the U.S. data. To be consistent with the White category in Canada, people with Arabic and West Asian origins in the U.S. data were grouped with those self-reporting as Asian.

relative concentration in STEM fields by population group. The analysis proceeds to compare the occupational outcomes of STEM-educated adults by immigration status in the two countries, including the share working in STEM occupations among individuals with a university degree in a STEM field and the share working in occupations requiring a university degree among individuals with a university degree in a STEM field.

To compare the relative earnings gaps between adult immigrants and the native-born population, the study samples of STEM-educated adults with non-zero annual earnings from Canada and the United States were pooled, and two regression models were estimated. Model 1 included dummy variables for country, immigrant status, and the interaction between country and immigration status. The results of this model show the observed earnings gap between immigrants and the native-born population in each country. Model 2 added the covariates common to both the native-born population and immigrants, and immigrant-specific covariates. Immigrant-specific covariates were entered as conditional interaction terms, i.e., their values were coded as 0 for native-born individuals, and for immigrants they were the deviation from the mean of each variable within the immigrant sample. These models were estimated separately for STEM-educated adults, those who worked in STEM occupations and those who worked in non-STEM occupations.

Both the ACS and Canadian census microdata files contain weights to compensate for differences in the sampling rates of different segments of the populations. In the regression models with pooled ACS and Canadian census data, the weights were standardized so that the sum of the standardized weights was the same for each subgroup (i.e., immigrants and the native-born population in each country) and was equal to the sample size of the smallest group. Standardizing these weights ensured that data from each subgroup contributed equally to the coefficient estimates in the models with pooled data.

# 4 Results

## 4.1 The supply of immigrant STEM graduates

Immigrants constitute a disproportionately high share of STEM-educated individuals in both Canada and the United States. This is particularly true in Canada, where immigration levels have been high—by historical standards—for a number of decades. In Canada, among adults aged 25 to 64 with a university degree in 2016, 44% of those educated in a STEM field were immigrants who arrived as adults (aged 18 or older at immigration). This proportion reached 72% among doctoral graduates in engineering and 68% among doctoral graduates in computer science and math (Table 1). These numbers are attributable to the fact that a large share of immigrants in Canada are highly educated, and highly educated immigrants are two to three times as likely as the Canadian-born population with a university education to have selected a STEM field of study. In 2016, 36% of university-educated immigrants held a STEM degree, compared with 18% of their Canadian-born counterparts. In the engineering, and computer science and math fields, this difference was even more pronounced: immigrants were three times as likely as Canadian-born individuals to be educated in a STEM field (Table 2). The high concentration of immigrants in STEM fields could create conditions conducive to the relative success of highly educated immigrants, as STEM graduates tend to do fairly well in the labour market.

**Table 1**
**Immigration status of the population aged 25 to 64 with a university degree, by STEM field of study and degree level, Canada, 2016, and the United States, 2015 to 2017**

| | Canada | | | United States | | |
|---|---|---|---|---|---|---|
| | Native-born population | Childhood immigrants | Adult immigrants | Native-born population | Childhood immigrants | Adult immigrants |
| | percent | | | | | |
| **All university graduates** | 63.0 † | 8.2 | 28.9 | 80.3 | 5.6 | 14.1 |
| Non-STEM fields | 68.0 | 7.8 | 24.2 | 84.0 | 5.2 | 10.8 |
| STEM fields | 47.1 | 9.2 | 43.8 | 69.1 | 6.8 | 24.0 |
| Science and technology | 60.5 | 9.8 | 29.7 | 76.0 | 6.8 | 17.2 |
| Engineering | 39.0 | 8.0 | 53.0 | 61.8 | 6.6 | 31.6 |
| Computer science and math | 38.4 | 10.4 | 51.2 | 66.5 | 7.3 | 26.2 |
| **Bachelor's degree** | 66.4 | 8.6 | 25.1 | 82.0 | 5.7 | 12.3 |
| Non-STEM fields | 70.7 | 8.0 | 21.3 | 84.3 | 5.3 | 10.4 |
| STEM fields | 52.6 | 10.4 | 37.0 | 73.9 | 7.0 | 19.2 |
| Science and technology | 66.5 | 11.0 | 22.5 | 80.8 | 6.5 | 12.7 |
| Engineering | 44.9 | 8.9 | 46.2 | 67.5 | 6.7 | 25.8 |
| Computer science and math | 44.9 | 12.7 | 42.4 | 72.3 | 8.1 | 19.6 |
| **Master's or professional degree** | 57.0 | 7.4 | 35.6 | 78.5 | 5.5 | 16.1 |
| Non-STEM fields | 62.7 | 7.6 | 29.7 | 83.8 | 5.0 | 11.3 |
| STEM fields | 35.6 | 6.7 | 57.7 | 64.7 | 6.7 | 28.6 |
| Science and technology | 53.6 | 8.2 | 38.2 | 74.3 | 7.2 | 18.5 |
| Engineering | 26.2 | 6.1 | 67.7 | 55.1 | 6.5 | 38.4 |
| Computer science and math | 23.4 | 5.5 | 71.1 | 56.7 | 6.0 | 37.3 |
| **Doctorate** | 47.7 | 6.5 | 45.8 | 67.2 | 5.7 | 27.1 |
| Non-STEM fields | 59.9 | 6.9 | 33.3 | 78.3 | 5.0 | 16.7 |
| STEM fields | 37.1 | 6.2 | 56.7 | 56.0 | 6.4 | 37.6 |
| Science and technology | 43.9 | 6.9 | 49.2 | 62.1 | 6.7 | 31.3 |
| Engineering | 23.1 | 4.9 | 72.0 | 39.0 | 5.9 | 55.1 |
| Computer science and math | 27.3 | 5.1 | 67.6 | 51.3 | 5.3 | 43.4 |

† This number means that, in 2016, 63.0% of the population aged 25 to 64 with a university degree were native-born individuals (i.e., they were born in Canada).

**Note:** STEM stands for science, technology, engineering and mathematics.

**Source:** Statistics Canada, 2016 Census of Population; the combined 2015 to 2017 American Community Survey.

In the United States, immigration rates are lower than in Canada and a smaller share of all immigrants are highly educated. Of STEM-educated adults aged 25 to 64 in the United States, 24% were immigrants (vs. 44% in Canada), and this figure reached as high as 55% among individuals with an engineering doctorate (vs. 72% in Canada) (Table 1). Among university-educated immigrants, the popularity of STEM disciplines is as strong in the United States as in Canada. Over the 2015 to 2017 period, university-educated immigrants were twice as likely to have selected a STEM field of study (43% among immigrants vs. 22% among American-born individuals) and three times as likely to have been educated in engineering as the American-born population (Table 2).

**Table 2**
**Percentage educated in a STEM field of study among university degree holders aged 25 to 64, by immigration status, Canada, 2016, and the United States, 2015 to 2017**

| | Canada | | | United States | | |
|---|---|---|---|---|---|---|
| | Native-born individuals | Childhood immigrants | Adult immigrants | Native-born individuals | Childhood immigrants | Adult immigrants |
| | percent | | | | | |
| **All university graduates** | | | | | | |
| All STEM fields | 18.0 | 27.1 | 36.5 | 21.5 | 30.6 | 42.5 |
| Science and technology | 8.8 | 11.0 | 9.4 | 10.6 | 13.6 | 13.5 |
| Engineering | 6.2 | 9.9 | 18.5 | 6.6 | 10.1 | 19.2 |
| Computer science and math | 3.0 | 6.2 | 8.6 | 4.4 | 6.9 | 9.7 |
| **Bachelor's degree** | | | | | | |
| All STEM fields | 19.0 | 29.3 | 35.4 | 19.9 | 27.2 | 34.3 |
| Science and technology | 8.6 | 11.0 | 7.7 | 8.5 | 9.9 | 8.9 |
| Engineering | 7.0 | 10.9 | 19.2 | 6.7 | 9.7 | 17.1 |
| Computer science and math | 3.4 | 7.4 | 8.5 | 4.7 | 7.6 | 8.4 |
| **Master's or professional degree** | | | | | | |
| All STEM fields | 13.1 | 19.1 | 34.1 | 22.9 | 34.3 | 49.3 |
| Science and technology | 7.2 | 8.5 | 8.2 | 12.6 | 17.6 | 15.3 |
| Engineering | 4.1 | 7.3 | 17.0 | 6.5 | 10.9 | 22.0 |
| Computer science and math | 1.8 | 3.3 | 8.9 | 3.8 | 5.7 | 12.1 |
| **Doctorate** | | | | | | |
| All STEM fields | 41.7 | 51.2 | 66.3 | 41.6 | 56.0 | 69.1 |
| Science and technology | 32.2 | 37.0 | 37.6 | 31.5 | 40.1 | 39.3 |
| Engineering | 6.4 | 10.0 | 20.8 | 6.2 | 11.2 | 21.8 |
| Computer science and math | 3.1 | 4.2 | 7.9 | 3.8 | 4.7 | 8.0 |

**Note:** STEM stands for science, technology, engineering and mathematics.

**Source:** Statistics Canada, 2016 Census of Population; the combined 2015 to 2017 American Community Survey.

Overall, immigrants held a larger share of the STEM jobs in Canada than in the United States. This is evident in the employment numbers (data not shown), which reflect the overall supply noted above. In Canada, 42% of workers with a university degree in a STEM field and employed in a STEM occupation were immigrants, compared with 30% in the United States. Once again, these figures were much higher at the doctoral level, which is important, as these individuals may play an important role in innovation (Blit, Skuterud and Zhang 2017). In Canada, immigrants accounted for 72% of engineering PhDs working in a STEM occupation and 67% of computer science and math PhDs. In the United States, the figures were lower, but still significant, at 60% and 50%, respectively.

Where STEM-educated immigrants were educated is important. Earlier research has shown that country of education is one of the major determinants of economic outcomes of immigrants in general (Bleakley and Chin 2004; Bratsberg and Ragan 2002), and of STEM-educated immigrants in particular (Boyd and Tian 2018). Using Canadian data, Boyd and Tian (2018) concluded that "degrees from countries in Eastern Europe and Asia are not as portable for STEM-educated immigrants as those from Canada, the USA, the UK and France." Picot and Hou (2019*a*) found similar results and showed that STEM-educated immigrants educated in the Philippines, Pakistan, Africa and parts of Asia had some of the poorest economic outcomes. STEM-educated immigrants educated in these countries accounted for almost 40% of all foreign-educated immigrants and one-third of all STEM-educated immigrants in Canada.

Details on country of education were not available in the U.S. data. For the U.S. data, only the proportion of immigrants educated in a foreign country based on years of schooling and age at

immigration could be estimated. Among STEM-educated immigrants aged 25 to 64 who entered the United States as adults, an estimated 68% received their highest degree in a foreign country, versus 78% in Canada. It is possible that, among immigrants who were not educated in the receiving country, those who were educated in other developed countries were more likely to choose the United States over Canada. Although it was not possible to estimate the precise effect of this difference because of data limitations, it may be a significant factor in some of the Canada–U.S. differences in immigrant outcomes.

## 4.2 Occupational outcomes

Two measures of occupational outcomes were used: the proportion of workers in a STEM occupation and the share of STEM workers in a job requiring a university degree. These particular measures were used because, to have the opportunity to affect the technical innovation and productivity associated with a STEM activity, employment in a STEM job is a necessary but not sufficient condition. STEM-educated individuals employed in non-STEM jobs may find that the skills acquired through their training are useful and relevant if they are employed in other high-skilled occupations. However, if they are employed in a low-skilled job, this is a conventional indication of overeducation.

### 4.2.1 The proportion of immigrants working in a STEM occupation

In both Canada (in 2016) and the United States (from 2015 to 2017), a little under one-half of STEM-educated adult immigrant workers had a STEM occupation (46% in Canada and 50% in the United States) (Table 3). There are two significant differences between the two countries.

First, in Canada the native-born population and immigrants achieved about the same level (about 46% in STEM jobs), while in the United States immigrants were much more likely to work in STEM jobs than their native-born counterparts (at 35%). There are a number of possible reasons for the U.S. results. For example, immigrants may prefer STEM jobs because of their reduced reliance on language skills and knowledge of the culture that many non-STEM jobs require. Among native-born STEM graduates, it may be that many prefer or are able to find non-STEM jobs in which they can apply their STEM skills and achieve similar or better career advancement.

The second difference between the two countries relates to recent immigrants—those entering the country in the previous decade. The proportion in STEM jobs was higher among recent immigrants than among all immigrants in the United States, at 56% (unadjusted). This suggests that the occupational outcomes of STEM-educated immigrants in the United States over the past decade have been better than during previous time periods, or that immigrants leave STEM jobs as they acquire host-country working experience. This outcome was different in Canada, as fewer recent immigrants found STEM jobs (44% unadjusted).

**Table 3**
**Share working in STEM occupations among individuals aged 25 to 64 with a university degree in a STEM field, by immigration status, Canada, 2016, and the United States, 2015 to 2017**

| | Canada | | | | United States | | | |
|---|---|---|---|---|---|---|---|---|
| | Native-born individuals | Childhood immigrants | Adult immigrants | Recent adult immigrants | Native-born individuals | Childhood immigrants | Adult immigrants | Recent adult immigrants |
| | percent | | | | | | | |
| Total | 46.5 | 47.9 | 46.2 | 44.1 | 34.6 | 37.4 | 49.7 | 56.4 |
| Science and technology | 26.3 | 22.8 | 29.1 | 26.7 | 21.0 | 20.8 | 36.3 | 42.9 |
| Engineering | 68.1 | 67.8 | 49.6 | 48.2 | 48.0 | 50.2 | 53.3 | 58.3 |
| Computer science and math | 59.1 | 57.6 | 56.5 | 52.8 | 46.8 | 50.2 | 60.7 | 66.8 |
| Bachelor's degree | 45.9 | 47.6 | 39.5 | 37.4 | 37.3 | 41.1 | 41.3 | 48.6 |
| Master's or professional degree | 45.4 | 47.4 | 52.7 | 50.8 | 28.4 | 31.0 | 51.7 | 59.2 |
| Doctorate | 58.8 | 55.0 | 61.9 | 58.4 | 42.8 | 40.5 | 70.4 | 76.7 |

**Note:** STEM stands for science, technology, engineering and mathematics.

**Source:** Statistics Canada, 2016 Census of Population; the combined 2015 to 2017 American Community Survey.

### 4.2.2 The proportion of immigrants in a job requiring a university degree

The proportion of university-educated STEM immigrants in a job requiring a university degree can be influenced by a number of factors, including the actual or perceived quality of the education received in the source country, a possible desire by employers to fill highly qualified jobs with individuals from universities or cultures with which they are familiar (particularly if there is no shortage of highly qualified workers), and discrimination. The supply–demand balance in highly skilled jobs can also affect this proportion (Picot and Hou 2019*b*).

Unsurprisingly, there is relatively little underemployment (i.e., working in jobs not requiring a university education) among STEM-educated immigrants working in STEM occupations. In Canada, 84% found themselves in jobs requiring a university degree, compared with 96% in the United States (Table 4).

The pattern is very different for the slightly over one-half of STEM-educated immigrants who worked in non-STEM jobs. In Canada, only 20% found a job requiring a university degree, compared with 40% of the Canadian-born population. This was much higher in the United States, at 48% among adult immigrants and 56% among the American-born individuals. Immigrants with an engineering degree who could not find a STEM job had particularly poor outcomes in Canada—only 13% found a job requiring a university degree, compared with 43% in the United States.

Overall, STEM-educated immigrants in the United States who were not in a STEM occupation did much better than their counterparts in Canada at locating a highly skilled job. Furthermore, STEM-educated immigrants in non-STEM jobs in the United States did not differ significantly from their American-born counterparts in locating highly skilled jobs. In Canada, most STEM-educated immigrants who could not find employment in a STEM occupation found lower-skilled jobs.

**Table 4**
**Share working in occupations requiring a university degree among individuals aged 25 to 64 with a university degree in a STEM field, by immigration status, Canada, 2016, and the United States, 2015 to 2017**

| | Canada | | | | United States | | | |
|---|---|---|---|---|---|---|---|---|
| | Native-born individuals | Childhood immigrants | Adult immigrants | Recent adult immigrants | Native-born individuals | Childhood immigrants | Adult immigrants | Recent adult immigrants |
| | percent | | | | | | | |
| In STEM occupations | 90.0 | 89.2 | 83.9 | 82.7 | 92.9 | 93.2 | 96.0 | 96.4 |
| Science and technology | 80.0 | 80.3 | 78.9 | 76.4 | 89.4 | 89.2 | 94.1 | 93.9 |
| Engineering | 94.9 | 92.6 | 83.6 | 83.0 | 94.3 | 94.5 | 95.9 | 96.5 |
| Computer science and math | 90.8 | 88.6 | 87.2 | 85.1 | 94.5 | 94.4 | 97.6 | 97.9 |
| Bachelor's degree | 88.8 | 88.0 | 78.2 | 76.3 | 91.2 | 91.2 | 93.5 | 95.0 |
| Master's or professional degree | 91.9 | 91.7 | 87.2 | 86.1 | 95.3 | 95.8 | 97.0 | 97.1 |
| Doctorate | 97.3 | 97.4 | 95.6 | 95.1 | 98.3 | 98.3 | 98.1 | 97.8 |
| In non-STEM occupations | 40.1 | 38.7 | 20.0 | 18.9 | 56.2 | 56.5 | 48.1 | 45.6 |
| Science and technology | 43.0 | 41.6 | 28.5 | 26.9 | 59.2 | 62.5 | 54.5 | 50.1 |
| Engineering | 26.7 | 28.7 | 12.8 | 12.7 | 50.1 | 48.8 | 42.8 | 42.5 |
| Computer science and math | 47.9 | 42.0 | 23.7 | 19.5 | 55.0 | 49.4 | 47.0 | 45.0 |
| Bachelor's degree | 32.4 | 31.5 | 12.7 | 10.9 | 41.2 | 38.6 | 31.6 | 31.9 |
| Master's or professional degree | 60.8 | 58.8 | 26.2 | 24.9 | 74.3 | 74.4 | 62.3 | 58.7 |
| Doctorate | 79.8 | 79.9 | 60.8 | 61.3 | 86.3 | 87.2 | 77.0 | 75.6 |

**Note:** STEM stands for science, technology, engineering and mathematics.

**Source:** Statistics Canada, 2016 Census of Population; the combined 2015 to 2017 American Community Survey.

## 4.3 The earnings gaps between immigrants and the native-born population in Canada and the United States

### 4.3.1 The earnings gap among STEM-educated immigrants

This section examines the gap in annual earnings between STEM-educated immigrants and the native-born population with positive earnings. The earnings were measured in 2015 for Canada and from 2014 to 2016 for the United States.

In the unadjusted data, there was a very large negative earnings gap (immigrants earned less than the native-born population) in Canada, and a small positive gap in the United States. STEM-educated immigrants in Canada earned 0.287 log points (roughly 25%) less than their native-born counterparts. In the United States, immigrants earned approximately 2% more than their native-born counterparts (Table 5, top panel, Model 1 for all occupations).

After a number of sociodemographic characteristics were controlled for, the large earnings gap in Canada became even more negative, increasing to 0.307 log points (26%). However, there was virtually no earnings gap between immigrant and native-born STEM-educated workers in the United States (Table 5, top panel, Model 2).

The difference between the unadjusted and adjusted results indicates the extent to which the control variables explain the unadjusted earnings gap. In Canada, these variables explained little of the gap. In the United States, there was not much of a gap to explain. Overall, these control variables accounted for little of the difference in earnings between immigrants and the native-born population.

Do STEM-educated immigrants with STEM jobs earn as much as their native-born counterparts? The analysis indicates that, in Canada, there was an unadjusted gap of 14% (0.145 log points) and an adjusted gap of 17% (0.182 log points). Therefore, when the analysis was restricted to STEM jobs, the gap was much smaller, but persisted. Again, the control variables explained virtually none of the negative gap because there was not much of a difference between the results of models 1 and 2. In the United States, STEM-educated immigrants working in STEM jobs earned more than their native-born counterparts, both unadjusted and adjusted.

The largest earnings gaps were observed among STEM-educated immigrants who did not find a STEM job (Table 5). In Canada, these immigrants earned 33% (-0.406 log points) less than their Canadian-born counterparts unadjusted and 34% adjusted. In the United States, this gap was much smaller, at around 7%.

### 4.3.2 The earnings gap for recent STEM-educated immigrants

The results reported above were for all adult STEM-educated immigrants, regardless of time spent in the receiving country. The relative Canada–U.S. outcomes for more recent entry cohorts may have changed. To assess this, models were run specifically for recent immigrants (those in the country for 10 years or less) (Table 5, bottom panel).

In Canada, earnings gaps between immigrants and the native-born population were wider for more recent immigrants, as expected, because it takes time to adjust to a new labour market. They earned almost 39% (-0.499 log points) less than their Canadian-born counterparts unadjusted and 34% adjusted. Even among those who found STEM jobs, they earned about 23% less than their Canadian-born counterparts (adjusted). Those who did not find STEM jobs earned 42% less (adjusted).

In comparison, in the United States, the outcomes of recent immigrants were not significantly different from those of all immigrants. While the unadjusted gap was about 17%, after accounting

for differences in sociodemographic characteristics, recent STEM-educated immigrants in the United States earned only 4% less than their native-born counterparts. STEM-educated immigrants with STEM jobs earned 2% less (adjusted).

Recent STEM-educated immigrants in Canada had relatively poor outcomes compared with their counterparts in the United States.[5]

**Table 5**
**Estimated earnings gaps between immigrant and native-born workers with a degree in a STEM field, Canada, 2015, and the United States, 2014 to 2017**

| | All occupations | STEM occupations | Non-STEM occupations |
|---|---|---|---|
| | | log points | |
| **All immigrants** | | | |
| **Model 1** | | | |
| Gaps in the United States | 0.024 *** | 0.059 *** | -0.079 *** |
| Gaps in Canada | -0.287 *** | -0.145 *** | -0.406 *** |
| **Model 2** | | | |
| Gaps in the United States | 0.005 | 0.038 *** | -0.071 *** |
| Gaps in Canada | -0.307 *** | -0.182 *** | -0.415 *** |
| **Recent immigrants** | | | |
| **Model 1** | | | |
| Gaps in the United States | -0.186 *** | -0.164 *** | -0.337 *** |
| Gaps in Canada | -0.499 *** | -0.325 *** | -0.613 *** |
| **Model 2** | | | |
| Gaps in the United States | -0.041 *** | -0.017 *** | -0.130 *** |
| Gaps in Canada | -0.414 *** | -0.255 *** | -0.539 *** |

*** significantly different from reference category ($p < 0.001$)

**Notes:** STEM stands for science, technology, engineering and mathematics. Model 1 includes country (Canada vs. United States), immigration status and the interaction term of these two variables. Model 2 controls for gender, age, degree level, field of study, race, city size and—for immigrants only—language, years since immigration, source region and whether they were educated in a foreign country.

**Source:** Statistics Canada, 2016 Census of Population; the combined 2015 to 2017 American Community Survey.

### 4.3.3 The variation in outcomes by selection category among recent Canadian immigrants

The analysis to this point looked at all immigrants with a university degree in a STEM field, regardless of how they were selected. This section examines whether the way economic immigrants are selected matters. The analysis here focuses on economic immigrant principal applicants who entered Canada under the Canadian Experience Class (CEC), Provincial Nominee Program, Quebec's Regular Skilled Worker Program or the Federal Skilled Worker Program. Similar information was not available in the U.S. data.

The study sample consisted of principal applicants aged 25 to 64 with a university degree in a STEM field who entered Canada in the 10 years prior to 2016. Three measures were examined: the share working in a STEM occupation; the share working in high-skilled occupations,

5. One difference between the results for recent immigrants and all immigrants is that accounting for differences in characteristics does explain a significant proportion of the unadjusted entry earnings gap for recent immigrants, but explains virtually none of the gap for all immigrants. For example, among all STEM-educated immigrant workers in Canada, differences in characteristics accounted for 17% of the unadjusted gap. In the United States, they accounted for three-quarters of the narrower earnings gap (Table 5).

i.e., requiring a university degree (among those not in a STEM occupation); and average annual earnings.

By all three measures, principal applicants entering under the CEC had the best outcomes. Two-thirds of these immigrants found a STEM job, and their average earnings were $81,400 (Table 6). By comparison, only 45% of provincial nominees found a STEM job, and their earnings were $71,500. Federal Skilled Worker Program principal applicants had occupational outcomes that fell between the two groups mentioned above, and a little over one-half found a job in a STEM occupation.

**Table 6**
**Skill utilization and earnings among economic immigrant principal applicants aged 25 to 64 with a university degree in a STEM field who arrived within 10 years, 2016**

| | Canadian experience class | Provincial nominees | Quebec skilled workers | Federal skilled workers |
|---|---|---|---|---|
| | | percent | | |
| **The share working in STEM occupations** | | | | |
| Total | 65.6 | 44.5 | 53.0 | 52.0 |
| Science and technology | 46.5 | 27.5 | 33.3 | 32.8 |
| Engineering | 69.3 | 17.8 | 54.1 | 55.3 |
| Computer science and math | 71.7 | 49.9 | 68.3 | 64.0 |
| **The share working in high-skilled occupations among those not working in STEM occupations** | | | | |
| Total | 35.0 | 13.5 | 22.1 | 24.6 |
| Science and technology | 45.6 | 25.8 | 30.6 | 34.7 |
| Engineering | 26.0 | 7.7 | 14.8 | 16.4 |
| Computer science and math | 37.4 | 13.4 | 27.3 | 27.3 |
| | | 2015 constant dollars | | |
| **Average earnings** | | | | |
| Total | 81,400 | 71,500 | 53,700 | 68,800 |
| Science and technology | 71,000 | 73,400 | 44,300 | 55,200 |
| Engineering | 88,200 | 75,900 | 55,300 | 74,800 |
| Computer science and math | 78,000 | 60,800 | 59,200 | 70,300 |
| **Average earnings among those not working in STEM occupations** | | | | |
| Total | 71,900 | 55,800 | 42,700 | 54,200 |
| Science and technology | 62,200 | 64,600 | 39,600 | 48,400 |
| Engineering | 83,500 | 56,800 | 44,400 | 58,600 |
| Computer science and math | 67,100 | 44,600 | 43,400 | 53,800 |

**Notes:** STEM stands for science, technology, engineering and mathematics. Earnings have been rounded to the nearest 100.

**Source:** Statistics Canada, 2016 Census of Population.

What were the outcomes of those who did not find a STEM job? Once again, principal applicants in the CEC fared the best—35% found a job in some other high-skilled occupation and earned an average of $71,900. Provincial nominees had the poorest outcomes. Among the 55% who did not find a STEM job, only 14% found a job in some other high-skilled occupation. Federal Skilled Worker Program principal applicants again fell somewhere in between, with around one-quarter of those not in a STEM job finding a job in a high-skilled occupation. Principal applicants who entered through Quebec Skilled Worker Program consistently had better occupational outcomes but lower earnings than provincial nominee immigrants. A high proportion of provincial nominee

immigrants worked in Canada as temporary foreign workers before immigration. As a result, they tended to have an earnings advantage over federal and Quebec skilled workers in the initial years after immigration (Hou, Crossman and Picot 2020b; Hou and Picot 2016).

Earlier research (Picot and Hou 2019*a*) found that, among three broad disciplines—science and technology, engineering, and computer science and math—immigrant engineers tended to have the poorest outcomes in Canada. However, this was somewhat more nuanced when examined by immigrant class. Engineering-trained principal applicants in the CEC had some of the best outcomes of the three disciplines—69% found a STEM job—and they had the highest earnings of the three disciplines (Table 6). Engineers in the Provincial Nominee Program had the opposite outcome: only 18% worked in a STEM job and, among those who did not find a STEM job, they had relatively low annual earnings ($56,800). Once again, outcomes for those in the Federal Skilled Worker Program fell between provincial nominees and CEC immigrants (Table 6).

# 5 Summary

This paper examined the differences between Canada and the United States in the economic outcomes of STEM-educated immigrants. The results refer to 2016 for Canada and from 2015 to 2017 for the United States. The analysis was restricted to immigrants aged 25 to 64 who held at least a bachelor's degree and were adults (i.e., 18 and older) at the time of immigration.

In both Canada and the United States, adult immigrants with at least a bachelor's degree were twice as likely as the native-born population to have studied in a STEM field, and they were three times as likely to have studied engineering or computer science and math.

Regarding occupational outcomes, over one-half of STEM-educated immigrant workers in both countries held non-STEM jobs. The extensive review conducted by the CCA (2016) concluded that—in general—this was not a significant issue because STEM skills are valued in many other occupations. This may hold for STEM graduates in general, but it does not hold for STEM-educated immigrants in Canada with non-STEM jobs. Most of these jobs do not require a university education. In Canada, only 20% of these immigrants found a job that required a university degree. This situation was better in the United States, at 48%.

Among all STEM-educated workers, immigrants earned 25% less than their native-born counterparts in Canada, even after accounting for differences in sociodemographic characteristics. There was no earnings gap between immigrants and the native-born population in the United States. Furthermore, differences in characteristics between STEM-educated immigrants and native-born individuals explained very little of the large negative earnings gap in Canada. In the United States, there was not much of a gap to explain.

Even among those who found STEM jobs, immigrants in Canada earned significantly less than Canadian-born individuals (17% less, adjusted). In the United States, immigrants earned slightly more than their native-born counterparts (4% more, adjusted).

The earnings gap between immigrants and the native-born population among those who did not find a STEM job was very pronounced in Canada (-34%, adjusted). The gap was much narrower in the United States (-7%, adjusted). In Canada, STEM-educated immigrants who did not find a STEM job typically found relatively low-paying jobs that did not require a university education. Outcomes were generally better in the United States. In Canada, the issue regarding the skill utilization of STEM-educated immigrants was more pronounced among the more than one-half who did not find a STEM job.

# 6 Discussion

Why are the economic outcomes of STEM-educated immigrants better in the United States than in Canada? Little direct research has been conducted on this question, although a number of possible explanations exist, including the following.

(1) The more positive selection by immigrants entering the United States

The United States has a reputation for being the first choice for many immigrants at the top of the ability distribution. It may be that the skills of STEM-educated immigrants entering the United States are higher on average than those of STEM-educated immigrants entering Canada or other developed countries. One paper examined the wage gap between immigrants and the native-born population among highly skilled immigrants in Canada, Australia and the United States. It found significantly higher earnings gaps in Australia and Canada than in the United States. The authors argued that the greater tendency by highly skilled immigrants to self-select into the United States over other countries was a primary factor in their better relative earnings outcomes in the United States (Clarke, Ferrer and Skuterud 2019). They suggested that, when comparing immigrant economic outcomes, the United States was the outlier among major immigrant destinations, primarily because of the more positive selection by immigrants into the United States.

(2) The greater supply of STEM-educated immigrants in Canada

As noted earlier, immigrants represent a much higher percentage of the STEM-educated workforce in Canada than in the United States. In particular, the number of STEM-educated immigrants who entered Canada rose significantly during the 1990s in response to the high-tech boom and has since remained at high levels (Clarke, Ferrer and Skuterud 2019; Picot and Hou 2019*b*). Canada does not face a general shortage of STEM workers (CCA 2016). In the absence of a shortage, employers looking for STEM workers may have a tendency to hire STEM graduates from universities in countries with which they are familiar and who have experience from countries with economies similar to Canada's. In this situation, immigrant and Canadian-born STEM workers would not be seen as perfect substitutes.

(3) Differences in the selection processes of highly skilled immigrants

Many highly skilled immigrants in the United States have a job offer upon arrival (e.g., through the H-1B or other visa programs) or are international students who can be interviewed by prospective employers easily. Research has shown that immigrants who entered the United States contingent on offers of employment were most likely to engage in skilled jobs (Chellaraj, Maskus and Mattoo 2005). In the United States, immigrants who entered on a student or trainee visa, or on a temporary work visa, had a significant advantage over the native-born population in wages, patenting and publishing. Much of this advantage is attributable to their comparatively higher levels of education (Hunt and Gauthier-Loiselle 2010). Immigrants who entered as regular permanent residents did not outperform native-born individuals. In Canada, the points-based system in use since the 1960s selects economic immigrants on the basis of their education, work experience, official language proficiency and—at times—occupation, but does not require prearranged employment or Canadian work experience. Most economic and STEM-educated immigrants included in this study entered under the traditional points system.

Significant changes were made to immigration selection in Canada recently—many new economic immigrants, particularly the highly skilled, are selected from the pool of temporary foreign workers. They are selected by employers to hold jobs in Canada prior to becoming permanent residents. Employers play a larger role in the selection of principal applicants in the CEC and Provincial Nominee Program than in the Federal Skilled Worker Program (Hou, Crossman and Picot 2020a). The results of this study indicate that STEM-educated immigrants

entering under the CEC do well relative to others, and those who are provincial nominees have the poorest outcomes. One major difference between the CEC and Provincial Nominee Program is that the former is restricted to temporary foreign workers with skilled jobs in Canada, while the latter also provides pathways for temporary foreign workers with low-skilled or medium-skilled jobs to become permanent residents (Hou, Crossman and Picot 2020b; Hou and Picot 2016; Lu and Hou 2017).

(4) Differences in country of education

Research has shown that country of education is one of the most important determinants of immigrant earnings, along with language and race or visible minority status. Country of education may differ significantly among STEM-educated immigrants in Canada and the United States. STEM immigrants educated in non-Western countries do not do as well economically as others for a number of possible reasons: the education quality may be lower (or perceived to be so); in the absence of a shortage of STEM workers (CCA 2016), employers may prefer to hire those educated in Western countries; and some credentials are not recognized by professional associations in the host country—either for valid or invalid reasons—and this may prevent immigrants from developing countries from obtaining STEM jobs. Language or cultural issues may also prevent immigrants from being able to use their STEM education. Discrimination may also play a role.

(5) Other factors unrelated to immigration policy

Factors unrelated to immigration policies and practices may also contribute to the superior outcomes of STEM-educated immigrants in the United States. For example, differences in industrial structure may result in a higher demand for STEM-educated workers in the United States relative to other countries.

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