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Skill Utilization and Earnings of STEM-educated Immigrants in Canada: Differences by Degree Level and Field of Study

by Garnett Picot and Feng Hou

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Abstract

In Canada, immigrants represented more than half of the population in the prime working ages with at least a bachelor's degree in the science, technology, engineering, and mathematics (STEM) fields of study in 2016. They accounted for three-quarters of engineering and computer science graduates with a master's or doctorate degree. This paper examines the skill utilization and earnings of employed STEM-educated immigrants by field of study and degree level. Compared with the Canadian-born with similar levels of education and in similar fields of study, immigrants with a bachelor's degree had considerably lower skill utilization rates and earnings outcomes than those of doctoral degree holders. This is mostly because immigrant doctoral graduates are more likely to be educated in a Western country. By field of study, immigrant engineering graduates, particularly at the bachelor's level, had relatively weaker skill utilization rates and earnings outcomes; immigrant computer science graduates did somewhat better. The slightly more than half of STEM-educated immigrants who did not find a STEM job had the weakest skill utilization rates and earnings outcomes. Much of the gap between the earnings of immigrant and Canadian-born graduates was associated with differences in country of education. STEM immigrants educated in Canada, the United States, the United Kingdom or France had outcomes similar to the Canadian-born.

Executive summary

This paper examines the skill utilization and earnings of employed immigrants with a university degree in the science, technology, engineering, and mathematics (STEM) fields. Unlike earlier papers, which dealt with immigrant STEM graduates as a whole, this paper disaggregates the results by field of study and degree level (bachelor's, master's, and doctoral).

In 2016, immigrants represented more than half of the population in the prime working age population that had a university degree in a STEM field in Canada. At the master's and doctoral levels in engineering and computer science, close to three-quarters were immigrants. This study focuses on immigrants with a university degree in STEM fields who entered Canada as adults (at 18 or over) and were aged 25 to 64 in 2016. Relative to the Canadian-born in similar fields and with similar levels of education, immigrants with bachelor's degrees had considerably lower skill utilization rates and earnings outcomes compared with those with doctoral degrees. For example, immigrant STEM bachelor's degree holders earned 32% less than their Canadian-born counterparts (unadjusted), and 28% less after adjusting for demographic, language, and working-time variables. The gap in the earnings of immigrant doctoral graduates relative to the Canadian-born was much smaller: 19% less in unadjusted earnings and 9% less in adjusted earnings. Immigrant master's degree holders were in the middle in terms of relative outcomes.

By field of study, immigrant **engineering** graduates, particularly at the bachelor's level, had relatively lower skill utilization rates and earnings. Only 39% of employed immigrant engineering graduates at the bachelor's level found a job requiring a university degree, whereas 71% of their Canadian-born counterparts did so. They also earned 43% less (unadjusted) than Canadian-born engineering bachelor's degree holders, and 32% less after adjusting for demographic, language, and working-time variables. Immigrant **computer science** graduates did somewhat better: bachelor's degree holders earned 33% less than the Canadian-born (unadjusted) and 18% less (adjusted). Both immigrant and Canadian-born **science** graduates tended not to work in STEM occupations (only 30% to 32% did so). This is likely because a bachelor's degree in science is less specialized than an engineering or computer science degree.

The slightly more than half of STEM-educated immigrants who did not find a STEM job had the weakest skill utilization rates and earnings outcomes. This was true for all three fields of study. Overall, only 20% found a job requiring a university degree (versus 41% of STEM-educated Canadian-born who did not find a STEM job). These STEM immigrants without STEM jobs earned 36% less than their Canadian-born counterparts who had not found a STEM job (unadjusted) and 31% less (adjusted). Again, immigrants with an engineering degree who did not find a STEM job fared the worst: only 15% found a job requiring a university degree and they earned 49% less (unadjusted) and 34% less (adjusted) than the Canadian-born without STEM jobs.

The country of education appears to be an important determinant. STEM immigrants educated in Canada, the United States, the United Kingdom or France had outcomes similar to those of the Canadian-born. STEM immigrants educated in other countries did less well, some very poorly. There may be many reasons why immigrant STEM graduates educated in non-Western countries have relatively poor outcomes. For example, it may be related to actual or perceived education quality. In the absence of a STEM labour shortage, employers may tend to hire graduates from universities and with labour market experience with which they are familiar. There may also be potential credential recognition issues in fields like engineering that are partially regulated.

1 Introduction

STEM (science, technology, engineering, and mathematics) skills, are increasingly regarded as essential to innovation, productivity growth and competitiveness, and consequently, to economic growth and a prosperous society. Much of the recent research in economics has focused on three topics: the supply and demand balance of STEM skills, the contribution of STEM workers to innovation, and the labour market outcomes of STEM graduates. STEM-educated immigrants—the focus of this paper—are an important component of all three topics. This is particularly true in Canada because in 2011, immigrants accounted for more than half of the current supply of STEM-educated individuals aged 25 to 54, although immigrants accounted for only about 21% of the population (Picot and Hou 2018).

This paper examines the economic outcomes of employed STEM-educated immigrants. Economic outcomes are measured by the likelihood of working in a STEM-related occupation, the likelihood of being in a job requiring a university degree, and the earnings gaps relative to comparable Canadian-born STEM graduates. This paper is different from earlier papers on this topic because it tackles the issue at a more disaggregated level. The paper employs three fields of study (engineering, computer science, and science and technology) and three degree levels (bachelor's, master's, and doctoral degrees). The most recent papers have focused on STEM-educated immigrants as a group (Boyd and Tian 2017; Picot and Hou 2018; CCA 2015).

This study asks three specific questions, by degree level and field of study: (1) Are STEM-educated immigrants employed in jobs that provide the opportunity to use their STEM skills and to potentially positively influence innovation and productivity? (2) Among those not employed in STEM jobs, do STEM skills open doors for them to other "good" jobs? (3) How successful are STEM immigrants economically, and what explains their earnings gap relative to the Canadian-born?

2 Recent research

The Council of Canadian Academies (CCA) reviewed recent research on STEM workers and skills as a whole. However, there have been only a handful of recent studies on the economic outcomes of immigrant STEM workers in Canada.

The CCA (2015) report on STEM skills and economic prosperity suggested that there was no general supply/demand imbalance regarding STEM skills in the Canadian labour market. It also found that Canada's productivity problem is not simply due to a shortage of STEM workers. According to this report, the majority of STEM-educated workers work in non-STEM fields (both among immigrants and the Canadian-born). However, this was not seen as an issue. The report argued that STEM skills are relevant and useful in many types of jobs, and can open doors for STEM-educated workers. 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 rates and lower employment rates than their Canadian-born counterparts.

Other recent papers have also examined the economic outcomes of STEM-educated immigrants. Blit, Skuterud and Zhang (2016) found that, over the period from 1986 to 2006, the probability of a STEM graduate being employed in a STEM job increased for the Canadian-born, but fell for immigrants. They suggest that the declining share of immigrant STEM graduates who work in a STEM occupation limits their ability to contribute to innovation in Canada. Picot and Hou (2018) found that, from 1985 to 2010, the education–occupation match (the share working in a STEM job and jobs requiring a university degree) as well as earnings outcomes deteriorated among immigrant STEM graduates while remaining more or less constant among Canadian-born STEM graduates. They found that the gap between the earnings of 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 have a STEM job.

Boyd and Tian (2017) showed that STEM-educated immigrants were less likely to work in a STEM occupation than the Canadian-born. This difference was associated with immigrants' language skills and the fact that they were more likely to have received their degree outside Canada. In a follow-up paper, Boyd and Tian (2018) found that the detailed country of education of STEM immigrants is an important determinant of both employment in a STEM job and earnings. The authors noted that "degrees from countries in Eastern Europe and Asia are not as portable for STEM-educated immigrants as those from Canada, the United States, the United Kingdom, and France." (Boyd and Tian 2018, under "Conclusion").

A U.S. study by Hanson and Slaughter (2016) found that, while there was a significant gap between the earnings of immigrants and the American-born working in non-STEM occupations (around 10%), there was virtually no average earnings difference between American-born and immigrant workers in STEM occupations. Clarke, Ferrer, and Skuterud (2018) arrived at similar results, but they concluded that immigrant STEM workers in the United States had higher earnings than their American-born counterparts. 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 relative to their American-born counterparts of around 6%, and that this gap disappeared after about six years, after which they earned more than the American-born. This result also differs from the Canadian findings reported above.

3 Data, measures, and methods

3.1 Data

The data for this study are drawn from the 25% sample microdata file of the 2016 Canadian Census of Population. The analyses are restricted to individuals who were aged 25 to 64 in 2016, who had at least a bachelor's degree, and who had studied in a STEM field. The study excludes childhood immigrants who arrived in Canada before 18 years of age. The purpose here is to examine the skill utilization and outcomes of immigrants who entered Canada as adults. The study is intended to provide useful information on the outcomes of immigrants—mainly economic immigrants—who were exposed to some component of the selection system. Children are not selected under this system, but rather, they enter as dependents of adult immigrants. As a result, they are excluded from this study. From this point on, unless otherwise noted, the term "immigrant" refers to immigrants who were at least 18 years of age upon arrival in Canada. Our study sample comprises 141,900 Canadian-born individuals and 135,780 adult immigrants. About 78% of these immigrant STEM graduates were admitted to Canada as economic immigrants. Economic immigrants generally have better labour market outcomes than family-class immigrants or refugees.

In the earnings analysis, the sample is further restricted to those who had positive annual employment income, and it excludes immigrants who arrived in the year of the census and the year before the census because they did not have a full year's earnings during the year of the census or the year before the census.

3.2 Measures

The STEM fields of study are drawn from the variant of Statistics Canada's 2011 Classification of Instructional Programs (CIP) for STEM groupings. STEM fields comprise three subfields: science/technology (physical and chemical sciences, biological sciences, general and integrated sciences, and technology fields of study), engineering, and computer science and mathematics (hereinafter referred to as "computer science"). Table A.1 in the Appendix lists the CIP codes for STEM fields of study.

The STEM occupations were based on the classification used by Blit, Skuterud and Zhang (2016) and Boyd and Tian (2017), who in turn followed the classification used by the U.S. Census Bureau and by other American studies (Landivar 2013a, 2013b; Langdon et al. 2011; Lowell 2010). A similar classification has been used in other Canadian studies (Picot and Hou 2018). Table A.2 in the Appendix lists the 2016 National Occupational Classification (NOC) codes for STEM occupations.

Part of the analysis examines the rate of STEM graduates who work in occupations that require a university degree. The NOC codes used in the 2016 Census provide information on the skill requirements associated with each occupation and reflect the education or training required for the job. In this article, the skill requirements are aggregated to two levels: occupations requiring a university degree, and occupations not requiring a university degree. The NOC does not assign specific educational levels to management occupations. For the purposes of this study, senior management occupations and specialized middle management occupations are treated as requiring a university degree.

3.3 Methods

A series of ordinary least squares (OLS) models are constructed to examine gaps between the earnings of immigrant and Canadian-born STEM graduates. These models are run for all STEM-educated workers by field of study, degree level, and whether they worked in a STEM occupation. The dependent variable is the logarithm of annual earnings (wages/salaries and net self-employment income). The focal independent variable is a dummy indicator for immigration status (immigrants versus the Canadian-born).

For each comparison, two sequential models are used. Model 1 controls for age, age-squared, degree level (in the field-of-study regression: bachelor's degree, master's degree, or doctorate), field of study (in the degree level regressions: science and technology, engineering, and computer science), geographic region, weeks worked, full-time or part-time status, language, and visible minority status. Geographic regions are based on province, except for the Atlantic Provinces, which are combined into one region. Language is coded as one of six categories based on the combination of mother tongue and self-reported official language: mother tongue is English; mother tongue is French; mother tongue is non-English and non-French but the individual speaks English; mother tongue is non-English and non-French but the individual speaks French; mother tongue is non-English and non-French but the individual speaks both English and French; and mother tongue is non-English and non-French and the individual does not speak English or French. Visible minority status is coded as visible minority or non-visible minority.

Model 2 adds the country of the institution from which they received the highest degree to Model 1. This variable is grouped into 16 categories: Canada, the top 10 countries from which university-educated immigrants received their degree (India, China, the Philippines, the United States, the United Kingdom, Iran, Pakistan, Romania, Russia, and France), and five regions (Latin America, other European countries, other Asian countries, Africa, and others) excluding the 10 top countries.

4 Results

4.1 The supply of immigrant STEM graduates

Immigrants make up a very high proportion of the supply of STEM-educated individuals in Canada, particularly among master's and doctoral graduates, and those in the engineering field. In 2016, over half (54%) of the university-educated STEM graduates in Canada were immigrants. This share varied by field of study and degree level. Among engineering and computer science graduates aged 25 to 64 in 2016, 61% were immigrants (adult immigrants and childhood immigrants together), compared to 41% among science and technology graduates. By degree level, 49% of bachelor's degree holders in STEM fields were immigrants. Among master's and doctoral STEM graduates, 64% were immigrants (Table 1). Combining field of study and degree level reveals pockets where immigrants played a very dominant role. Among engineering and computer science graduates with a master's degree or doctorate, roughly three quarters were immigrants. Immigrants represented about 22% of the Canadian population in 2016. Their overrepresentation among engineering and computer science graduates and those with higher-level degrees is very significant, rendering knowledge of their outcomes even more important. Immigrants' share of STEM employment reflects their overrepresentation of labour supply. They accounted for 42% of bachelor's level STEM employment, and almost two thirds (63%) of master's and doctorate level STEM jobs.

Table 1
Proportion of immigrant university degree holders, aged 25 to 64, 2016

	Share of immigrants		Estimated population			
	Childhood immigrants	Adult immigrants	All	Canadian-born	Childhood immigrants	Adult immigrants
	percent		counts ('000)			
All university graduates						
Non-STEM fields	7.8	24.0	3,976.9	2,713.1	309.0	954.9
STEM fields	9.4	44.2	1,259.2	584.6	117.8	556.8
Science and technology	10.1	31.0	471.0	277.6	47.5	145.8
Engineering	8.0	53.0	525.9	205.1	42.1	278.7
Computer science and mathematics	10.7	50.4	262.3	101.8	28.2	132.3
Total	8.1	28.9	5,236.1	3,297.7	426.7	1,511.7
Bachelor's degree						
Non-STEM fields	7.9	21.1	2,662.7	1,891.8	209.8	561.1
STEM fields	10.7	37.8	839.3	432.4	89.8	317.1
Science and technology	11.5	25.0	290.6	184.7	33.4	72.5
Engineering	8.9	46.2	364.6	163.7	32.5	168.4
Computer science and mathematics	13.0	41.4	184.1	84.0	23.9	76.2
Total	8.6	25.1	3,502.0	2,324.2	299.6	878.2
Master's degree						
Non-STEM fields	7.6	29.6	1,228.0	770.8	93.2	364.0
STEM fields	6.8	56.9	339.8	123.3	23.2	193.3
Science and technology	8.2	37.2	131.2	71.6	10.8	48.7
Engineering	6.1	67.8	139.3	36.3	8.5	94.4
Computer science and mathematics	5.5	72.3	69.3	15.4	3.8	50.1
Total	7.4	35.5	1,567.8	894.2	116.3	557.3
Doctorate						
Non-STEM fields	7.0	34.5	86.2	50.4	6.0	29.7
STEM fields	6.0	58.0	80.1	28.8	4.8	46.5
Science and technology	6.7	49.9	49.2	21.3	3.3	24.6
Engineering	4.9	71.9	22.0	5.1	1.1	15.9
Computer science and mathematics	5.0	67.9	8.9	2.4	0.4	6.0
Total	6.5	45.8	166.3	79.3	10.9	76.2

Note: STEM: science, technology, engineering and mathematics.

Source: Statistics Canada, 2016 Census of Population.

4.2 Where were they educated?

The country where the highest degree was earned is an important determinant of the economic outcomes of all immigrants (Bleakley and Chin 2004; Bratsberg and Ragan 2002; Picot and Hou 2019; Zeng and Xie 2004) and STEM immigrants (Boyd and Tian 2017, 2018). In 2016, about one-fifth of STEM immigrants who entered Canada as adults and were aged 25 to 64 years were educated in Canada. When we add other Western countries from which Canada receives a significant number of STEM immigrants, including the United States, the United Kingdom and France, this proportion rises to about 32%. The other 68% were educated in other countries.

Table 2
Percentage distribution of adult immigrants aged 25 to 64 with at least a bachelor's degree in a STEM field, by country or region of highest education, degree level and field of study, 2016

		Degree level			Field of study		
	Total	Bachelor's degree	Master's degree	Doctorate	Science and technology	Engineering	Computer science and mathematics
				percent			
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Canada	21.3	16.0	25.8	38.5	20.8	19.1	26.3
India	11.2	12.3	11.1	3.8	14.3	8.5	13.3
China	11.2	13.6	8.0	7.7	7.9	13.5	10.0
Philippines	7.7	12.4	1.8	0.1	5.1	9.5	6.8
United States	4.3	2.9	5.3	9.4	4.7	3.4	5.5
United Kingdom	3.5	2.8	3.7	7.5	4.2	2.8	4.0
Iran	3.4	4.1	2.6	1.2	3.5	4.1	1.7
Pakistan	3.0	3.3	3.2	0.3	4.2	2.1	3.7
Romania	2.9	2.8	3.5	0.8	1.4	4.1	1.8
Russia	2.7	1.7	4.2	4.0	2.3	3.1	2.4
France	2.6	0.8	4.5	7.0	3.3	2.0	3.1
Latin America	4.4	5.4	3.7	1.0	3.6	5.2	3.7
Other European countries	8.2	5.5	11.9	10.6	8.1	9.3	5.8
Africa	4.8	6.0	3.7	1.7	6.8	4.3	3.8
Other Asian countries	8.2	9.8	6.4	5.1	9.0	8.4	7.1
Others	0.7	0.6	0.7	1.4	0.9	0.5	1.0
				number			
Sample size	135,775	77,386	47,074	11,315	35,508	69,002	32,265

Notes: STEM: science, technology, engineering and mathematics. Percentages may not add up to 100.0% because of rounding.
Source: Statistics Canada, 2016 Census of Population.

There were also important differences by degree level. Among STEM bachelor's degree holders, about one-quarter were educated in Canada, the United States, the United Kingdom or France, while roughly three-quarters were educated elsewhere, with the highest numbers coming from China, the Philippines and India (Table 2). Among STEM doctoral graduates, we observe the opposite pattern. About two-thirds (63%) were educated in Canada, the United States, the United Kingdom, or France; the rest received their university education elsewhere. Master's degree holders were in between these two groups, with 39% being educated in the four Western countries. These differences seem to affect the skill utilization and earnings of immigrant bachelor's, master's and doctoral degree holders, since immigrants educated in Western countries tend to have better labour market outcomes in terms of earnings and the types of jobs they find than those educated in other countries.

The distributions by country of education were broadly similar for the three major fields of study (Table 2). Slightly more computer science graduates than graduates with a science or engineering degree were educated in Canada.

4.3 Utilization of STEM immigrants in the Canadian labour market

Two measures of the utilization of STEM university-educated immigrants in the Canadian labour market are used: the proportion of workers in a STEM occupation, and the proportion of workers in jobs requiring a university degree.

4.3.1 Proportion working in a STEM occupation

Overall, in 2016, the share of STEM-educated workers in STEM occupations was about the same for immigrants (46%) as for the Canadian-born (48%) (Table 3), but there were considerable differences between immigrants and the Canadian-born in specific areas. First, among engineering bachelor's degree holders—a large segment of the STEM-educated population—the STEM employment rate was much higher among the Canadian-born (66%) than among immigrants (42%). This suggests that immigrant engineering graduates do not have the same opportunities or skills as their Canadian-born counterparts to contribute to innovation and productivity growth through a STEM job. Both immigrants and the Canadian-born who had a bachelor's degree in science, also a large segment of the STEM population, had very low STEM employment rates (22% and 25% respectively). A Bachelor of Science is more of a general degree that can lead down many educational and employment paths other than a STEM occupation. Immigrants who have a bachelor's degree in computer science also posted a lower STEM employment rate than the Canadian-born. However, when compared with the Canadian-born, immigrant engineers reported the lowest relative STEM employment rate (Table 3).

Table 3
Percentage of employed individuals aged 25 to 64 with at least a bachelor's degree in a STEM field who were working in a STEM occupation, 2016

	Science and technology	Engineering	Computer science and mathematics	Total
		percent		
Canadian-born				
Total	30.4	65.7	56.7	47.6
Bachelor's degree	24.8	66.2	58.0	47.2
Master's or professional degree	36.4	62.6	46.6	45.5
Doctorate	56.9	71.3	75.0	61.0
Adult immigrants				
Total	31.9	48.3	54.4	45.6
Bachelor's degree	22.0	41.9	48.8	39.3
Master's or professional degree	34.4	55.6	60.7	51.8
Doctorate	54.1	70.8	70.5	62.0
Immigrants by country or region of highest education				
Canada	40.0	66.1	61.9	58.3
Abroad	29.7	43.9	51.7	42.0
India	20.3	52.6	46.4	40.4
China	35.6	43.1	56.9	44.8
Philippines	18.4	24.9	20.5	22.9
United States	42.3	58.5	58.6	53.9
United Kingdom	39.6	55.7	56.2	50.7
Iran	28.5	44.9	43.2	40.6
Pakistan	19.0	40.2	45.3	34.9
Romania	41.7	52.3	71.2	53.9
Russia	45.5	40.2	68.1	47.3
France	39.1	55.1	65.5	52.9
Latin America	31.1	46.9	64.5	47.3
Europe, other	40.9	47.0	65.7	48.7
Africa	20.9	41.0	47.8	35.3
Asia, other	22.2	38.2	46.1	35.5
Other countries	43.8	62.6	61.1	56.0

Note: Doctoral graduates trained in science, technology, engineering and mathematics (STEM) fields who were working as a university professor are counted in the STEM occupations.
Source: Statistics Canada, 2016 Census of Population.

This study finds that the STEM employment rate was generally lower among adult immigrants educated abroad (42%) than among those educated in Canada (58%), a finding consistent with Boyd and Tian (2018). This observation did not apply to all countries, however. The results show high STEM employment rates among immigrants educated in the United States, the United Kingdom, Romania, and France. Immigrants with a STEM university degree from the Philippines—a major source of STEM immigrants—had very low STEM employment rates: only around one-quarter found a job in a STEM field.

There is particular interest in the skill utilization of immigrant doctoral graduates, since they contribute disproportionately to innovation, at least as measured by patents filed (Blit, Skuterud and Zhang 2018). Again, in general, adult immigrant doctorate holders educated in Canada have higher STEM employment rates (66%) than those educated abroad (59%) (table not shown). However, STEM doctoral graduates educated in India, Iran, and Africa have the lowest STEM employment rates,[1] below 50%.

4.3.2 Proportion in jobs requiring a university degree

The proportion of STEM workers in a job requiring a university degree was much higher among the Canadian-born (64%) than among immigrants (49%) (Table 4). The largest gap between immigrants and the Canadian-born was observed among bachelor's degree holders, particularly among those with an engineering degree. Only 39% of immigrants with a bachelor of engineering were in a job requiring a degree, compared with 71% of the Canadian-born with a bachelor of engineering. The differences between immigrants and the Canadian-born at the doctoral level were much smaller.

There was large variation by country of education (Table 4). The share of STEM immigrants who earned a degree in Canada, the United States, the United Kingdom or France and who had a job requiring a university degree was similar to that of the Canadian-born. For all other countries, the share was much lower. STEM university graduates from the Philippines had the poorest results: only 16% held a job requiring a degree. The low level of employment by Filipino graduates in jobs requiring a university degree was observed in all three fields of study—computer science, engineering, and science and technology. The Philippines has been the number one source country of immigrants to Canada in recent years. In 2016, more immigrants with a bachelor's degree in a STEM field had received their degree from the Philippines than from any other foreign country. Other immigrants with relatively low levels of employment in jobs requiring a university degree included those educated in Pakistan, Africa, and Asia (other).

Relatively few (21%) immigrants with a university degree in a STEM field who did not find a STEM job managed to find a job that required a university degree, while 41% of Canadian-born workers were in a similar situation. Again, immigrants with an engineering degree were the worst off. Among the just over half who did not find a STEM job, only 15% found a job requiring a university degree; the rate among Canadian-born engineering graduates was 31%. Not surprisingly, there was huge variation by degree level, with immigrant bachelor's degree holders doing much less well (Table 4). In most categories, if immigrant STEM graduates did not find a STEM job, they did not find a good job, that is, one with higher pay that makes use of their education. Canadian-born STEM graduates fared better in this situation.

1. Too few doctoral graduates are educated in the Philippines and Pakistan to provide reliable numbers.

Table 4
Percentage of jobs held that required a university degree, workers aged 25 to 64 with at least a bachelor's degree in a STEM field, 2016

	STEM graduates				
	Science and technology	Engineering	Computer science and mathematics	Total	Non-STEM graduates
	percent				
All					
Canadian-born					
Total	54.3	72.9	73.1	64.2	60.8
Bachelor's degree	43.0	71.4	71.4	59.5	53.3
Master's or professional degree	72.5	77.4	79.0	74.7	76.9
Doctorate	88.3	89.7	94.0	89.0	90.9
Adult immigrants					
Total	42.4	47.9	59.0	49.2	36.7
Bachelor's degree	25.7	38.6	50.7	38.7	27.6
Master's or professional degree	46.9	58.1	67.3	57.8	46.9
Doctorate	79.5	83.7	90.3	82.4	78.6
Immigrants by country or region of highest education					
Canada	60.5	71.3	70.4	68.3	57.2
Abroad	37.4	42.1	54.8	43.8	30.7
India	28.0	50.1	48.4	42.5	22.7
China	38.9	40.7	58.6	44.2	30.7
Philippines	11.6	16.4	20.1	16.4	15.9
United States	62.0	63.4	67.9	64.4	55.3
United Kingdom	61.1	62.1	67.3	63.2	52.4
Iran	31.1	46.7	43.8	42.5	35.0
Pakistan	22.7	35.8	43.7	33.9	23.5
Romania	44.9	47.3	73.6	51.0	34.5
Russia	53.1	39.0	72.6	49.2	34.5
France	61.0	59.8	75.4	64.7	49.4
Latin America	33.0	44.8	62.1	45.9	29.1
Europe, other	49.6	45.2	69.0	50.5	36.9
Africa	27.7	42.1	51.0	38.8	38.6
Asia, other	30.4	37.8	49.3	38.1	26.0
Other countries	56.5	72.0	66.7	65.2	48.5
Working in a STEM occupation					
Canadian-born					
Total	80.6	94.8	91.1	89.8	71.8
Bachelor's degree	72.2	94.5	90.5	88.7	66.9
Master's or professional degree	87.6	95.5	92.7	91.5	84.6
Doctorate	96.3	97.7	99.7	97.0	88.9
Adult immigrants					
Total	76.1	83.6	87.1	83.3	73.1
Bachelor's degree	60.4	78.1	83.8	77.6	64.6
Master's or professional degree	75.4	88.2	89.4	86.5	79.6
Doctorate	94.2	96.0	97.9	95.5	86.6
Not working in a STEM occupation					
Canadian-born					
Total	42.8	31.0	49.5	41.0	60.3
Bachelor's degree	33.4	26.1	44.9	33.4	52.7
Master's or professional degree	63.8	47.0	67.0	60.8	76.7
Doctorate	77.7	69.7	76.7	76.6	90.9
Adult immigrants					
Total	26.7	14.5	25.4	20.6	34.9
Bachelor's degree	16.0	10.0	19.2	13.6	26.2
Master's or professional degree	31.9	20.3	33.2	26.9	44.7
Doctorate	62.1	54.0	72.0	61.0	78.2

Note: STEM: science, technology, engineering and mathematics.
Source: Statistics Canada, 2016 Census of Population.

To summarize, in terms of working in a STEM occupation, employed immigrants with a Bachelor of Engineering were significantly underutilized relative to their Canadian-born counterparts, with the exception of those educated in Western countries. In terms of working in a job requiring a degree, there is an issue of utilization in all three fields of study—engineering, computer science, and science and technology—with engineering being the most pronounced. The issue of underutilization is greatest at the bachelor's level and less significant at the doctorate level. Finally, utilization rates were very low for employed STEM immigrants who were not working in a STEM job.

4.4 Gaps between the earnings of STEM-educated immigrants and the Canadian-born

4.4.1 The earnings gaps of all employed STEM-educated immigrants

The earnings of immigrants (relative to comparable Canadian-born) have long been an important measure of their economic integration. Earnings serve as a marker for how well immigrants are doing economically in their new country.

Like earlier research (Boyd and Tian 2017, 2018; Picot and Hou 2018), this study finds a significant unadjusted gap (-26.8%) in 2015 between the earnings of STEM-educated immigrants and their Canadian-born counterparts (Table 5). By field of study, immigrants with an engineering degree fared the worst, with an overall gap of -38.5% with the Canadian-born. Immigrant science and technology graduates (-25.2%) and computer science and mathematics graduates (-28.6%) each posted a smaller, yet significant gap.

By degree level, immigrant bachelor's degree holders did worse (-31.9% gap relative to Canadian-born bachelor's degree holders) than those with a master's degree (-20.1% gap) or a doctorate (-19.3% gap). Engineers with a bachelor's degree fared the worst overall, with a gap of -43.4%. Even immigrant engineers with a doctorate did not do well, posting a gap of -24.1%. Immigrants with a doctorate in computer science had the best result, with a gap of -11.4% (Table 5).

These results represent unadjusted (observed) earnings gaps. OLS regression is used to control for differences between immigrants and the Canadian-born educated in a STEM field in variables that can affect the observed earnings gaps. Separate models are run for each degree level–field of study combination. The dependent variable is the logarithm of annual earnings. The independent variables include an immigrant–Canadian-born dummy; the coefficient of this variable is of primary interest. Other control variables include age, age squared, gender, weeks worked, full-time status, language, visible minority status, region of residence, field of study (for degree-level models), and degree level (for field-of-study models).

After controlling for such differences, the earnings gaps are generally smaller, since differences in these variables collectively account for some of the unadjusted earnings gaps noted above (Table 5). However, even after such controls, the main observations noted above persist. By field of study, the immigrant–Canadian-born earnings gap was found to be greatest among engineers (-28.2%) and smallest among computer science graduates (-16.3%). By degree level, the largest adjusted gaps continue to be observed among bachelor's degree holders (-27.5%), while the smallest was found among doctoral graduates (-9.3%).[2]

A second OLS model is run, which includes all the above independent variables, as well as the country of education of the highest degree. Adding this variable reduces the adjusted gaps significantly (Table 5). For all STEM graduates, adding a country-of-education variable reduced the gap by 41%,[3] in comparison, the reduction associated with Model 1, above, was 10%. Again, there is significant variation by field and degree type. In particular, adding the country of education reduced 23% of the gap observed among STEM doctoral graduates. That is because roughly two-thirds of STEM immigrant doctoral graduates received their degree in Canada, the United States, the United Kingdom, or France (Model 2, Table 5).

To summarize, the gap between the earnings of immigrants and the Canadian-born was largest among STEM bachelor's degree holders and smallest among doctoral graduates. It was larger among engineering graduates than among computer science graduates. Graduates with a bachelor of engineering had the largest earnings gaps. These patterns held after adjusting for differences in the variables included in Model 1. Adding country of education (Model 2) accounted for more of the initial observed gap than all the variables in Model 1. The exception was found at the doctorate level, where country of education accounted for a smaller portion of the initial gap. That is because most immigrant doctoral graduates received their degree from a Western country.

2. These reported earnings gaps are an average for all immigrants in a particular field or with a particular type of degree. However, the gap between the earnings of the Canadian-born and immigrants also depends on years since immigration. Among all employed STEM-educated immigrants, those in Canada for two to five years earned 45.6% less (unadjusted) than the Canadian-born STEM-educated. The other results were as follows: 6 to 10 years in Canada, 32.5% less; 11 to 15 years, 19.7% less; and over 15 years, 9.3% less. To produce adjusted results in Model 1, the immigrant status dummy was replaced by a series of "years since immigration" dummy variables. This produces estimates of the gap by years since immigration. The results reported above for fields of study generally remain the same, but recent immigrants had a larger gap than established immigrants. Among all employed STEM-educated immigrants (across all fields of study and degree levels), the adjusted gaps were as follows: after two to five years in Canada, immigrants earned 29.2% less than comparable Canadian-born; after 6 to 10 years in Canada, 27.1% less; after 11 to 15 years in Canada, 24.8% less; and more than 15 years in Canada, 15.5% less.
3. This is a conservative estimate of the share of the total observed gap accounted for by country of education. This is because this variable is the last to be added to the regression model, and may be correlated with other variables that were added in Model 1. Some of the effect of country of education may be captured by variables entered earlier, such as visible minority status.

Table 5
Estimated gaps between the earnings of immigrant and Canadian-born STEM and non-STEM graduates, by field of study and degree level, 2015

	STEM graduates				
	All STEM fields	Science and technology	Engineering	Computer science and mathematics	Non-STEM graduates
	percent				
All degree levels					
Observed	-26.8 ***	-25.2 ***	-38.5 ***	-28.6 ***	-34.1 ***
Adjusted, Model 1	-24.1 ***	-23.2 ***	-28.2 ***	-16.3 ***	-26.9 ***
Adjusted, Model 2	-13.0 ***	-15.8 ***	-14.6 ***	-8.3 ***	-14.1 ***
Bachelor's degree					
Observed	-31.9 ***	-29.7 ***	-43.4 ***	-33.4 ***	-35.1 ***
Adjusted, Model 1	-27.5 ***	-26.5 ***	-31.5 ***	-18.0 ***	-27.3 ***
Adjusted, Model 2	-15.6 ***	-17.1 ***	-17.4 ***	-10.6 ***	-13.9 ***
Master's degree					
Observed	-20.1 ***	-30.1 ***	-30.6 ***	-21.7 ***	-37.9 ***
Adjusted, Model 1	-21.3 ***	-25.8 ***	-20.8 ***	-13.4 ***	-28.4 ***
Adjusted, Model 2	-10.9 ***	-18.5 ***	-7.7 ***	-5.1	-17.0 ***
Doctorate					
Observed	-19.3 ***	-23.5 ***	-24.1 ***	-11.4 *	-21.6 ***
Adjusted, Model 1	-9.3 ***	-8.8 ***	-12.4 **	-9.0	-2.7
Adjusted, Model 2	-4.9 *	-6.9 *	-5.9	-6.3	4.3

* significantly different from reference category (p < 0.05)

** significantly different from reference category (p < 0.01)

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

Note: Reference category is Canadian-born. Model 1 controls for age, age squared, gender, field of study, degree level, geographic region of residence, language, visible minority status, weeks worked and full-time status. Model 2 further controls for country or region of highest degree of education.

S**ource:** Statistics Canada, 2016 Census of Population.

4.4.2 The earnings gap of STEM immigrants working in a STEM occupation

The gaps between the earnings of immigrants and the Canadian-born still existed among STEM graduates who worked in a STEM job, but were much smaller than those among all STEM graduates (compare Table 6, top panel, with Table 5). Overall, STEM-educated immigrants working in a STEM job earned 13.8% less than the Canadian-born after adjusting for the variables in Model 1. Again, this gap was largest among engineers (earning 18.4% less) and bachelor's degree holders (earning 17.3% less, Table 6). Among immigrant doctoral graduates, there was virtually no gap relative to the Canadian-born in adjusted earnings (Model 1). However, for others, having a STEM job did not eliminate the gap between the earnings of immigrants and the Canadian-born.

Table 6
Estimated gaps between the earnings of immigrant and Canadian-born STEM graduates, by STEM occupation, field of study, and degree level, 2015

	All STEM fields	Science and technology	Engineering	Computer science and mathematics
		percent		
STEM graduates working in a STEM occupation				
All degree levels				
Observed	-13.4 ***	-8.4 ***	-19.3 ***	-14.3 ***
Adjusted, Model 1	-13.8 ***	-8.6 ***	-18.4 ***	-11.2 ***
Adjusted, Model 2	-8.4 ***	-6.3 **	-10.4 ***	-8.1 ***
Bachelor's degree				
Observed	-18.5 ***	-15.2 ***	-24.1 ***	-16.3 ***
Adjusted, Model 1	-17.3 ***	-14.2 ***	-21.2 ***	-12.3 ***
Adjusted, Model 2	-11.5 ***	-10.2 **	-12.1 ***	-9.3 ***
Master's degree				
Observed	-5.2 ***	-10.3 ***	-14.9 ***	-13.8 ***
Adjusted, Model 1	-12.0 ***	-11.6 ***	-12.2 ***	-11.8 ***
Adjusted, Model 2	-5.4 **	-8.8 **	-5.3 *	-8.7 **
Doctorate				
Observed	-8.3 ***	-10.5 ***	-16.0 ***	-9.4
Adjusted, Model 1	-2.6	-0.6	-11.4 *	-0.2
Adjusted, Model 2	0.1	-1.8	-6.8	0.5
STEM graduates not working a STEM occupation				
All degree levels				
Observed	-35.8 ***	-32.7 ***	-49.3 ***	-42.0 ***
Adjusted, Model 1	-30.7 ***	-30.1 ***	-34.1 ***	-24.4 ***
Adjusted, Model 2	-21.2 ***	-21.5 ***	-22.9 ***	-14.8 ***
Bachelor's degree				
Observed	-36.1 ***	-32.8 ***	-50.9 ***	-43.5 ***
Adjusted, Model 1	-32.6 ***	-30.4 ***	-37.2 ***	-25.4 ***
Adjusted, Model 2	-22.6 ***	-20.3 ***	-25.7 ***	-18.4 ***
Master's degree				
Observed	-36.6 ***	-38.8 ***	-44.6 ***	-41.1 ***
Adjusted, Model 1	-29.6 ***	-34.0 ***	-27.9 ***	-23.5 ***
Adjusted, Model 2	-19.3 ***	-25.5 ***	-15.4 ***	-11.3 *
Doctorate				
Observed	-35.7 ***	-35.7 ***	-43.0 ***	-7.3
Adjusted, Model 1	-18.3 ***	-19.1 ***	-15.0	-18.8
Adjusted, Model 2	-13.7 ***	-15.4 **	-10.2	-14.9

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

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

Note: Reference category is Canadian-born. Model 1 controls for age, age squared, gender, field of study, degree level, geographic region of residence, language, visible minority status, weeks worked and full-time status. Model 2 further controls for country or region of highest degree of education.

Source: Statistics Canada, 2016 Census of Population.

4.4.3 The earnings gaps for STEM-educated immigrants not working in a STEM occupation

Very large earnings gaps relative to the Canadian-born are observed among university-educated STEM immigrants who did not have a STEM occupation (Table 6, bottom panel). These immigrants accounted for just over half (54%) of all immigrant STEM graduates in 2016. Overall, they earned 35.8% less than Canadian-born STEM graduates in non-STEM jobs (observed gap). Even after controlling for differences in many variables that can affect earnings (Model 1), including language and visible minority status, they earned 30.7% less.

While there was significant variation by field of study and degree level, no single group did particularly well. Immigrants in all three fields of study and at all degree levels who did not have a STEM job had large earnings gaps relative to their Canadian-born counterparts, ranging from -15% to -37% (Table 6, bottom panel, Model 1). As mentioned above, the just over half of engineering graduates who found themselves in this situation—particularly those with a bachelor's degree—fared the worst.

5 Conclusion

This paper addresses the skill utilization and earnings of immigrants in Canada with a university degree in a science, technology, engineering, and mathematics (STEM) field. Unlike earlier papers, which dealt with immigrant STEM graduates as a whole, this paper disaggregates the results by field of study and degree level.

STEM-educated immigrants constitute a very large share of both the supply and employment of STEM graduates in the Canadian economy. In 2016, over half of university-educated STEM graduates aged 25 to 64 were immigrants, although immigrants accounted for 22% of the country's population. The share is much higher in some fields and degree levels. The findings show that 61% of engineering graduates and roughly three-quarters of engineering and computer science graduates with a master's degree or doctorate were immigrants. Employment numbers reflected the supply data. Immigrants accounted for 42% of bachelor's degree holders employed in a STEM field and for 63% of jobs held by STEM master's degree or doctorate holders.

Employed immigrant STEM bachelor's degree holders had considerably lower labour market outcomes relative to those with a higher degree level. This was particularly true in engineering. In 2015, only 42% of employed immigrants with an engineering bachelor's degree worked in a STEM occupation (66% among the Canadian-born), and only 39% were in a job requiring a university degree (71% among the Canadian-born). Immigrants with a bachelor of engineering earned 43.4% less (unadjusted) than their Canadian-born counterparts. Even after controlling for differences in demographic characteristics, language and visible minority status, they earned 31.5% less.

Science graduates were much less likely to work in a STEM job than engineering or computer science graduates. A science degree is more general than a degree in engineering or computer science, particularly at the bachelor's level. In comparison with the other two fields, immigrant computer science graduates did relatively well, but even their outcomes were well below those of the Canadian-born. The low proportion working in a job requiring a university degree suggests that, relative to the Canadian-born, there is an issue of skill utilization among adult immigrants in all three fields of study—engineering, computer science, and science and technology.

Outcomes for immigrant doctoral graduates more closely resembled those of the Canadian-born, in part because the majority were educated in a Western country. However, immigrant engineering doctoral graduates fared less well than those in computer science or science.

The group with the poorest labour market outcomes were the roughly half of employed STEM-educated immigrants who did not find a STEM job. Once again, immigrants with an engineering degree posted the poorest results. Only 15% had found a job requiring a university degree (compared with 31% among the Canadian-born), and they earned 49% less (unadjusted) than their Canadian-born counterparts.

Country of education was important, as was observed in earlier research (Boyd and Tian 2018) and in this paper. STEM immigrants educated in Canada, the United States, the United Kingdom, or France had outcomes similar to those of Canadian-born STEM workers. Those educated in other countries, who accounted for 68% of STEM-educated immigrants, had poorer outcomes; in some cases, the outcomes were very poor. For example, only 16% of STEM-educated immigrant workers from the Philippines—one of the largest source countries for engineering bachelor's degree holders—had a job requiring a university degree. Immigrants with a STEM degree from Pakistan, Africa, and parts of Asia also had very poor outcomes.

There can be many reasons why employed STEM immigrants educated in a non-Western country do not do as well, on average, in the Canadian labour market. First, the quality of the education received may not provide the skills required in a STEM job requiring a university degree. It may also be that, being unsure of the quality of many universities in non-Western countries, and in the absence of a shortage of STEM workers, or possibly even an oversupply in fields like engineering, employers prefer to fill university level jobs with graduates from Canadian universities or universities from Western countries rather than from universities in developing countries. There may be an issue with credential recognition that prevents immigrants from obtaining jobs requiring a university education. This may indicate that the skills learned in STEM university programs in immigration source countries are not up to Canadian standards. It may also be that regulatory bodies in Canada are slow to recognize foreign credentials. Finally, language issues may prevent immigrants from putting their education to use in addition to possible discrimination.

The Council of Canadian Academics report (2015) noted that STEM skills are relevant and useful in many types of jobs outside STEM occupations, and can open doors for STEM-educated workers. This may be true for the Canadian-born, but it is less clear for immigrants. Picot and Hou (2018) and Boyd and Tian (2017) found very poor outcomes for STEM-educated immigrants working in a non-STEM field. This tends to hold true in all STEM fields of study, but is most pronounced among engineering graduates. When more than half of employed STEM-educated immigrants end up in non-STEM jobs with poor economic outcomes, this raises questions about selection and the role of foreign-educated STEM workers in Canada.

Appendix

Table A.1
Fields of study in the Variant of the Classification of Instructional Programs (CIP) 2011 – STEM groupings

Grouping and code	Title
Science; and Technology, except engineering technology	
1.09	Animal sciences
1.1001	Food science
1.11	Plant sciences
1.12	Soil sciences
3.0104	Environmental science
3.0301	Fishing and fisheries sciences and management
3.0502	Forest sciences and biology
3.0601	Wildlife, fish and wildlands science and management
19.0904	Textile science
26	Biological and biomedical sciences
30.01	Biological and physical sciences
30.06	Systems science and theory
30.1	Biopsychology
30.18	Natural sciences
30.19	Nutrition sciences
30.25	Cognitive science
30.27	Human biology
30.3	Computational science
30.32	Marine sciences
40	Physical sciences
42.2704	Experimental psychology
42.2706	Physiological psychology/psychobiology
42.2709	Psychopharmacology
42.2799	Research and experimental psychology, other
1.1002	Food technology and processing
1.1099	Food science and technology, other
3.0509	Wood science and wood products/pulp and paper technology
4.0902	Architectural and building sciences/technology
13.0501	Educational/instructional technology
29.0501	Military technologies and applied sciences
41	Science technologies/technicians
43.0106	Forensic science and technology
43.0204	Fire systems technology
45.0702	Geographic information science and cartography
Engineering and engineering technology	
14	Engineering
15	Engineering technologies and engineering-related fields

Note: LAN: local area network; STEM: science, technology, engineering and mathematics; WAN: wide area network.

Source: Statistics Canada, n.d., *Variant of CIP 2011 – STEM groupings*.

Table A.1
Fields of study in the Variant of the Classification of Instructional Programs (CIP) 2011 – STEM groupings (continued)

Grouping and code	Title
Mathematics and computer sciences	
10.0304	Animation, interactive technology, video graphics and special effects
11.01	Computer and information sciences and support services, general
11.02	Computer programming
11.03	Data processing and data processing technology/technician
11.04	Information science/studies
11.05	Computer systems analysis/analyst
11.07	Computer science
11.08	Computer software and media applications
11.09	Computer systems networking and telecommunications
11.1001	Network and system administration/administrator
11.1002	System, networking and LAN/WAN management/manager
11.1003	Computer and information systems security/information assurance
11.1004	Web/multimedia management and webmaster
11.1006	Computer support specialist
11.1099	Computer/information technology administration and management, other
11.9999	Computer and information sciences and support services, other
13.0603	Educational statistics and research methods
27	Mathematics and statistics
30.08	Mathematics and computer science
30.16	Accounting and computer science
30.31	Human computer interaction
42.2708	Psychometrics and quantitative psychology
43.0116	Cyber/computer forensics and counterterrorism
45.0603	Econometrics and quantitative economics
50.0411	Game and interactive media design
51.0709	Medical office computer specialist/assistant
51.27	Medical illustration and informatics
52.1302	Business statistics
52.1304	Actuarial science

Note: LAN: local area network; STEM: science, technology, engineering and mathematics; WAN: wide area network.

Source: Statistics Canada, n.d., *Variant of CIP 2011 – STEM groupings*.

Table A.2
STEM occupations in the 2016 National Occupational Classification (NOC)

NOC code	Minor group or unit group
211	Engineering managers
212	Architecture and science managers
213	Computer and info systems managers
2111	Physicists and astronomers
2112	Chemists
2113	Geoscientists and oceanographers
2114	Meteorologists and climatologists
2115	Other professional occupations in physical sciences
2121	Biologists and related scientists
2122	Forestry professionals
2123	Agricultural representatives, consultants and specialists
2131	Civil engineers
2132	Mechanical engineers
2133	Electrical and electronics engineers
2134	Chemical engineers
2141	Industrial and manufacturing engineers
2142	Metallurgical and materials engineers
2143	Mining engineers
2144	Geological engineers
2145	Petroleum engineers
2146	Aerospace engineers
2147	Computer engineers (except software engineers and designers)
2148	Other professional engineers, n.e.c.
2151	Architects
2152	Landscape architects
2153	Urban and land use planners
2154	Land surveyors
2161	Mathematicians, statisticians and actuaries
2171	Information systems analysts and consultants
2172	Database analysts and data administrators
2173	Software engineers and designers
2174	Computer programmers and interactive media developers
2175	Web designers and developers

Note: n.e.c.: not elsewhere classified; STEM: science, technology, engineering and mathematics.

Source: Authors' adaptation from J. Blit, M. Skuterud and Z. Zhang, 2016, *Immigrants and Patents: Evidence from Canadian Cities;* and M. Boyd and S. Tian, 2018, "Is STEM education portable? Country of education and the economic integration of STEM immigrants," *Journal of International Migration and Integration.*

Table A.2
STEM occupations in the 2016 National Occupational Classification (NOC) (continued)

NOC code	Minor group or unit group
2211	Chemical technologists and technicians
2212	Geological and mineral technologists and technicians
2221	Biological technologists and technicians
2222	Agricultural and fish products inspectors
2223	Forestry technologists and technicians
2224	Conservation and fishery officers
2225	Landscape and horticulture technicians and specialists
2231	Civil engineering technologists and technicians
2232	Mechanical engineering technologists and technicians
2233	Industrial engineering and manufacturing technologists and technicians
2241	Electrical and electronics engineering technologists and technicians
2242	Electronic service technicians (household and business equipment)
2243	Industrial instrument technicians and mechanics
2244	Aircraft instrument, electrical and avionics mechanics, technicians and inspectors
2251	Architectural technologists and technicians
2252	Industrial designers
2253	Drafting technologists and technicians
2254	Land survey technologists and technicians
2255	Technical occupations in geomatics and meteorology
2261	Non-destructive testers and inspection technicians
2262	Engineering inspectors and regulatory officers
2271	Air pilots, flight engineers and flying instructors
2274	Air traffic controllers and related occupations
2281	Computer network technicians
2282	User support technicians
2283	Information systems testing technicians

Note: n.e.c.: not elsewhere classified; STEM: science, technology, engineering and mathematics.

Source: Authors' adaptation from J. Blit, M. Skuterud and Z. Zhang, 2016, *Immigrants and Patents: Evidence from Canadian Cities;* and M. Boyd and S. Tian, 2018, "Is STEM education portable? Country of education and the economic integration of STEM immigrants," *Journal of International Migration and Integration*.

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