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The North American Free Trade Agreement (NAFTA), which came into effect in 1994, was designed to facilitate the mobility of skilled labour across Canada, Mexico and the United States. Under the NAFTA and the Canada–United States–Mexico Agreement that replaced the NAFTA, Canadian citizens who have a pre-arranged job in selected professions with a U.S. employer can work temporarily in the United States for up to three years through simplified procedures.¹ During the 1990s, Canada experienced a net loss of skilled workers to the United States, and the “brain drain” to the United States was driven mainly by medical professions (e.g., physicians and nurses) (Zhao, Drew and Murray, 2000). In today’s world, where research and development in the science, technology, engineering, mathematics and computer science (STEM) sector drive economic prosperity, the brain drain of STEM workers has become a growing concern.

The popularity of STEM fields in Canadian postsecondary education and the number of STEM graduates have grown among both Canadian and international students. The number of Canadian graduates from STEM postsecondary programs at the bachelor’s level or higher increased from 45,380 in 2010 to 63,250 in 2021, and the number of international student graduates quadrupled from 5,550 to 24,900 (Statistics Canada, n.d.). The share of international students among total STEM graduates went up from 11% to 28% during the same period.²

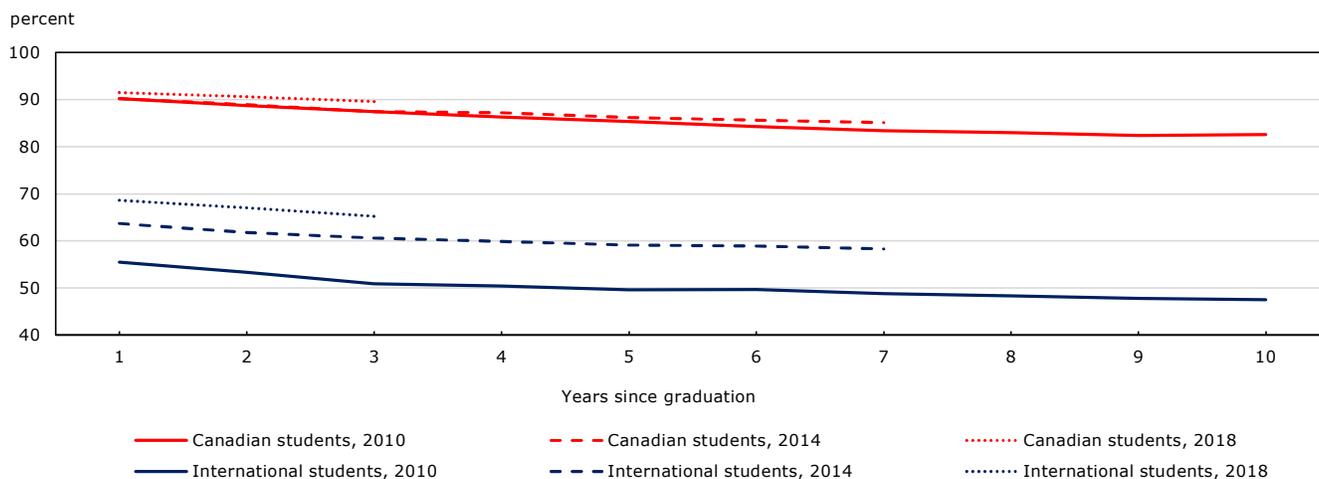
What is unknown is how many STEM graduates stay and contribute to the Canadian labour market. STEM knowledge is relatively transferable across borders. The U.S. tech industry attracts skilled workers from around the world with high-paying jobs, and the NAFTA made it easier for Canadian citizen STEM graduates to move to the United States. Some international graduates may stay in Canada on post-graduation work permits, while others may choose to seek job opportunities in other countries, especially if their home countries offer strong career prospects. Recent evidence suggests that some STEM graduates, including some of the brightest Canadian students, left Canada after graduation (Blit, Skuterud and Zhang, 2024).

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1. The professions listed in the trade agreement include accountants, computer systems analysts, engineers, mathematicians, statisticians, scientists, medical professions and teachers (<https://www.uscis.gov/working-in-the-united-states/temporary-workers/tn-nafta-professionals>).
 2. The numbers were calculated based on Statistics Canada (n.d.).

This study aims to examine STEM graduates’ retention in Canada after completing Canadian postsecondary programs. While it is difficult to accurately measure emigration from Canada (Hou, 2024), previous studies have used tax filing data to examine the retention or active presence of workers, immigrants and postsecondary graduates in Canada (Zhao, Drew and Murray, 2000; Qiu, Hou and Crossman, 2021; Blit, Skuterud and Zhang, 2024). This study relies on data from the Postsecondary Student Information System (PSIS) and T1 Family File (T1FF). The PSIS contains detailed information on all students who graduated from provincially funded postsecondary institutions in Canada from 2010 onwards.³ Graduates who file an individual (T1) income tax return in Canada appear in the T1FF.⁴ This article uses information on whether a person appeared in the T1FF to proxy for the person’s presence in Canada.⁵ Those who do not appear in the T1FF may include people who stayed in Canada but did not file a tax return, as well as people who left the country and ceased filing. With the currently available data, the two situations cannot be separately identified.

This study focuses on Canadian and international graduates from STEM degree programs (bachelor’s, master’s and doctoral degrees) at provincially funded universities and colleges in Canada from 2010 to 2020. The percentages of graduates who filed tax returns up to 10 years after graduation were calculated. The immigrant status of students in Canada was measured at the time of graduation. Canadian students include both Canadian citizens and permanent residents.

Chart 1
Percentage of Canadian and international science, technology, engineering, mathematics and computer science graduates who filed tax returns in Canada by year of graduation and years since graduation



Sources: Statistics Canada, Postsecondary Student Information System and T1 Family File.

3. Before 2010, graduation information from a limited number of provinces was available.
 4. In some cases, people appear in the T1FF without filing an individual tax return, including people whose spouse is an individual income tax filer and people who receive the Canada child benefit.
 5. A very small share of people living abroad file a tax return in Canada.

Recent science, technology, engineering, mathematics and computer science graduates were more likely to file income tax returns in Canada than earlier graduation cohorts

Chart 1 plots the percentages of Canadian and international students who graduated from STEM degree programs in 2010, 2014 and 2018. Among Canadian students who graduated in 2010, 90% appeared in the T1FF in the first year after graduation. This share decreased over time after graduation to 87% in year 3, 85% in year 5 and 83% in year 10. Canadian students who graduated in 2018 showed a similar pattern during the first three years after graduation at slightly higher levels (92% in year 1 and 90% in year 3).

Across graduation cohorts from 2010 to 2018, increasing shares of international student graduates filed tax returns in Canada. While 51% of the 2010 cohort of international students appeared in the T1FF three years after graduation, 65% of the 2018 cohort did so. This increase is consistent with the increase in the number of post-graduation work permit holders (Crossman, Lu and Hou, 2022).

Table 1
Percentage of science, technology, engineering, mathematics and computer science degree program graduates who filed tax returns by status of student in Canada and years since graduation

	Canadian students					International students				
	2010-to-2014 cohort			2015-to-2020 cohort		2010-to-2014 cohort			2015-to-2020 cohort	
	Year 1	Year 3	Year 5	Year 1	Year 3	Year 1	Year 3	Year 5	Year 1	Year 3
	percent					percent				
All fields	91.6	89.9	88.7	92.6	91.1	48.1	45.0	43.7	57.6	53.6
Non-STEM	92.0	90.5	89.5	93.1	91.8	42.3	39.5	38.2	50.8	47.4
STEM total	90.3	87.7	85.7	91.2	88.9	60.5	56.6	55.3	67.4	63.6
Field of study										
Physical and chemical science, biological science, and general and integrated science	90.5	88.3	86.4	92.1	90.1	48.5	43.8	42.7	55.8	51.9
Engineering and engineering technology	91.0	88.1	86.0	91.2	88.7	66.7	63.1	61.7	73.9	69.3
Mathematics and related studies	86.9	83.1	80.7	88.4	85.9	54.4	50.0	48.7	53.7	53.1
Computer and information science	88.4	85.3	83.6	88.7	86.1	65.3	62.4	61.4	71.1	68.3
Degree level										
Bachelor's degree	90.5	88.2	86.4	91.2	89.1	54.4	51.0	50.0	58.1	55.6
Master's degree	91.3	89.1	87.2	92.1	90.1	67.0	64.1	62.9	75.7	72.2
Doctoral degree	86.0	80.1	76.2	87.5	83.4	55.2	46.3	43.9	62.6	54.2
Country of citizenship										
Canada	90.8	88.7	87.0	91.4	89.4
United States	77.5	71.1	66.7	81.1	77.9	27.0	21.4	20.1	34.5	29.0
China	87.2	81.4	77.1	86.1	81.0	61.0	57.2	55.9	56.0	55.9
India	88.0	83.3	79.0	90.6	86.3	81.1	77.3	75.7	88.8	86.4
Other	87.5	82.3	78.2	90.6	86.6	58.6	54.9	53.7	67.2	62.5
World university ranking										
High-ranking universities	86.7	82.9	80.1	86.8	83.5	54.4	50.0	48.4	59.1	55.6
Other universities and colleges	91.9	89.7	88.1	92.9	91.1	63.7	60.2	59.1	71.5	67.5
Pre-graduation earnings										
Maximum annual T4 earnings within 10 years before graduation										
No Canadian earnings	60.7	59.2	58.2	65.3	65.2	42.4	40.0	39.4	43.5	43.3
Below \$20,000	91.4	88.6	86.3	92.7	90.5	70.8	65.9	64.0	80.3	75.0
\$20,000 to \$49,999	92.2	89.5	87.6	92.7	90.2	81.7	76.5	74.9	88.7	84.9
\$50,000 or more	94.4	92.5	91.0	94.5	92.5	86.8	83.8	81.9	89.4	86.8

... not applicable

Notes: STEM stands for science, technology, engineering, mathematics and computer science. The percentage of graduates who filed a tax return in year *N* after graduation was measured as appearance in the T1 Family File in the *N*-th calendar year after graduation. Canadian students are Canadian citizens and permanent residents at the time of graduation. Estimates for year 3 for the 2015-to-2020 graduate cohort are based on 2015-to-2018 graduates. High-ranking universities are the universities that were listed in the top 100 universities in the *Times Higher Education* World University Rankings 2025 in the fields of engineering, computer science and physical sciences.

Sources: Statistics Canada, Postsecondary Student Information System and T1 Family File.

The percentage of science, technology, engineering, mathematics and computer science graduates who filed tax returns in Canada varied by field of study and degree level

The percentages of STEM graduates who appeared in the T1FF were disaggregated by field of study and degree level for two graduation cohorts (2010 to 2014 and 2015 to 2020) of Canadian and international students (Table 1). Among Canadians who graduated from 2015 to 2020, 86% of graduates from mathematics and related studies and computer and information science programs filed tax returns three years after graduation. This rate was lower than the average rates for all STEM graduates (89%) and non-STEM graduates (92%). Under the NAFTA, computer systems analysts and mathematicians could benefit from enhanced mobility.

Canadian doctoral degree graduates (83%) were less likely to file tax returns in Canada than graduates from bachelor's (89%) and master's (90%) degree programs. Doctoral degree holders may be more likely to seek positions abroad to enhance their career prospects, build international collaborations and gain exposure to different research environments. Also, they could easily move to the United States as teachers at the university level and scientists under the NAFTA.

Wider variations in the tax filing rates were observed among international students. Among the 2015-to-2020 cohort of international students, graduates from programs in engineering and engineering technology (69%) and computer and information science (68%) were more likely to be actively present in Canada three years after graduation than graduates from programs in other STEM fields (53% for mathematics and related studies). Graduates from master's degree programs (72%) were more likely to have filed tax returns in Canada three years after graduation than graduates from bachelor's (56%) and doctoral (54%) degree programs.

Graduates from the United States had low rates of filing tax returns in Canada after graduation, whereas Indian graduates had relatively high rates, similar to the rate of Canadian citizen graduates

Among the 2015-to-2020 cohort of Canadian students, 89% of graduates with Canadian citizenship filed tax returns in Canada three years after graduation (Table 1). Permanent resident graduates had lower tax filing rates, and their rates varied by country of citizenship (78% for graduates from the United States and 86% for India). Compared with Canadian students, international student graduates had lower rates of tax filing, except for those from India. Three years after graduation, 86% of Indian graduates filed tax returns, whether they were permanent residents or international students at the time of graduation. This rate was not far below the rate for Canadian citizen graduates (89%). In contrast, less than 30% of international students from the United States filed tax returns in Canada three years after graduation.

Science, technology, engineering, mathematics and computer science graduates from high-ranking universities were less likely to file tax returns in Canada than graduates from other universities and colleges

For both Canadian and international students, graduates from highly ranked universities with strong STEM programs were less likely than other graduates to file tax returns in the early years after graduation (Table 1).⁶ Among the 2015-to-2020 cohort, 84% of Canadian and 56% of international STEM graduates from high-ranking universities appeared in the T1FF three years after graduation. The rates for graduates of other institutions were higher (91% of Canadian students and 68% of international students). The university ranking matters particularly for computer and information science and engineering. Among the

6. High-ranking universities are those that were listed in the top 100 universities in the *Times Higher Education* World University Rankings 2025 in the fields of engineering, computer science and physical sciences. These universities include the University of Toronto, the University of British Columbia, the University of Waterloo, McGill University, the Université de Montréal and the University of Alberta.

2015-to-2020 cohort of Canadian graduates in the field of computer and information science, 77% of graduates from high-ranking universities filed their tax returns in Canada, whereas 90% of other graduates did so (not presented in the table). STEM graduates from high-ranking universities may be more mobile and have a higher chance of finding a high-paying job in other countries, including the United States, because their university credentials are more likely to be recognized and valued in foreign labour markets.

Lastly, tax filing rates after graduation varied by whether a person had work experience before graduation and the level of the highest annual earnings that the person had within 10 years before graduation (Table 1). People with higher earnings before graduation were more likely than those with lower pre-graduation earnings to file tax returns in Canada during the first few years after graduation. People with work experience before graduation were more likely to file tax returns after graduation than those who did not have earnings or file tax returns before graduation. Having no pre-graduation work experience reflects various possible scenarios: the tendency of the population aged under 25 years to have lower tax filing rates and their persistent non-filing habit, wealthy students not needing to work to meet financial needs, students not intending to stay in Canada not seeing the need to work in the country, and students being unable to find work.

Summary

The retention of STEM graduates has improved in the last decade for both Canadian and international students. However, retention varied by educational and demographic characteristics. Canadian STEM graduates generally showed higher retention rates compared with international graduates. Among Canadian students, graduates from mathematics and computer and information science programs, graduates with a doctoral degree, and graduates from high-ranking universities were less likely to stay in Canada than other students. The lower retention rates among graduates from high-ranking universities and those with advanced degrees are particularly insightful. Among international students, graduates from engineering and computer and information science, graduates from master's degree programs, and graduates from India were more likely to stay in Canada. The majority of American students left after completing their postsecondary studies.

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