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A Gender Analysis of the Occupational Pathways of STEM Graduates in Canada

by Kristyn Frank

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Abstract

Occupations related to science, technology, engineering and mathematics (STEM) are generally associated with high pay and contribute to the development of new technology. Continued growth is expected for STEM occupations, which would provide STEM-educated workers with additional labour market opportunities. However, less is known about the extent to which STEM graduates enter into and remain in STEM occupations in Canada. This study uses data from the 2006 and 2016 longitudinal census files to examine the occupational pathways of women and men with postsecondary credentials in STEM fields. Generally, male STEM graduates were more likely than female STEM graduates to be employed in a STEM occupation. The occupational pathways of male and female STEM graduates also differed. Among STEM graduates who were employed in a STEM occupation in 2006, women were more likely than men to have moved to a non-STEM occupation by 2016. Younger STEM graduates were more likely to exit a STEM occupation than older graduates, and men and women with college-level STEM credentials were more likely to leave a STEM occupation than their counterparts with a bachelor's degree. Some differences in the occupational mobility of men and women with STEM credentials were associated with their field of study. For example, men who studied mathematics or computer and information sciences were less likely than their counterparts who studied engineering or engineering technology to exit a STEM occupation between 2006 and 2016. However, there was no statistically significant difference in the likelihood of leaving a STEM occupation among women who had studied in these two fields. Lastly, the wage growth of male and female STEM graduates who persisted in a STEM occupation between 2006 and 2016 was not significantly different from the wage growth of their counterparts who had moved from a STEM occupation to a non-STEM occupation.

Executive summary

Occupations related to science, technology, engineering and mathematics (STEM) are often characterized as high-quality, high-paying jobs. Continued growth is expected for STEM occupations, which suggests that there will be greater demand for STEM-educated workers in the future. Increasing women's participation in STEM fields has been identified as one way of meeting the growing demand for STEM-trained workers. However, despite increases in women's educational attainment and participation in scientific occupations over the past several decades, women remain underrepresented in STEM fields.

Much of the research on women in STEM fields concentrates on "leaks" in the STEM pipeline throughout their educational training. However, less is known about the loss of women from STEM after they obtain STEM credentials and how this compares with their male peers.

This study uses data from the 2006 and 2016 longitudinal census files, which integrate individuals across census years. A gender-based approach is employed to investigate the occupational pathways of women and men with postsecondary credentials in STEM fields who were aged 25 to 54 in 2006. This study addresses the following research questions:

1. What are the occupational pathways of STEM graduates in Canada and do the pathways of men and women differ?
2. What sociodemographic and educational characteristics are associated with the likelihood of a STEM graduate exiting a STEM occupation? Are there differences between men and women?
3. Do the earnings of STEM graduates who persist in STEM occupations differ from their counterparts who move to non-STEM occupations? Does this differ between men and women?

Generally, male STEM graduates were more likely than female STEM graduates to be employed in a STEM occupation. While over 4 in 10 men in the longitudinal sample were employed in STEM occupations in 2006, less than 3 in 10 women worked in a STEM occupation. Previous research has found that engineering graduates are more likely than life science graduates to work in STEM occupations (Statistics Canada 2017a). Over one-third of women in the longitudinal sample had studied biological, general or integrated sciences, while more than half of men had studied engineering or engineering technology. Therefore, it is likely that the differences observed in men's and women's likelihood of working in a STEM occupation is partly attributable to differences in their specific field of study choices.

Furthermore, the occupational mobility of male and female STEM graduates differed—women with STEM credentials were less likely than their male counterparts to persist in STEM occupations between 2006 and 2016. About one-quarter (26.4%) of male STEM graduates who were employed in a STEM occupation in 2006 had moved to a non-STEM occupation by 2016, compared with more than one-third of women (34.7%). Some of the top non-STEM occupations to which STEM graduates moved were similar for both men and women, such as specialized middle management occupations and professional occupations in business and finance.

Generally, most sociodemographic characteristics were not associated with the likelihood of men or women exiting STEM occupations, but with one exception—younger graduates were more likely to exit these fields than older graduates. Furthermore, STEM graduates with college-level credentials were more likely to exit a STEM occupation than their counterparts with a bachelor's degree.

Graduates who studied engineering and engineering technology were less likely to leave STEM occupations between 2006 and 2016 than graduates of physical or chemical sciences or

biological, general or integrated sciences. This was observed for both men and women. However, there were differences in the occupational mobility of men and women who studied mathematics or computer and information sciences. While men who studied mathematics or computer and information sciences were less likely than their counterparts who studied engineering or engineering technology to leave a STEM occupation between 2006 and 2016, there was no statistically significant difference between women who had studied these two fields.

Lastly, the results indicated that the wage growth of women and men who persisted in a STEM occupation between 2006 and 2016 was not significantly different from the wage growth of their counterparts who had moved from a STEM occupation to a non-STEM occupation between these years. Therefore, while STEM occupations may be higher paying than non-STEM occupations on average, STEM graduates who exited a STEM occupation did not experience significantly lower wage growth than their peers who persisted in a STEM occupation.

1 Introduction

Occupations related to science, technology, engineering and mathematics (STEM) are often characterized as high-quality, high-paying jobs that foster innovation and the development of new technology (Landivar 2013). Continued growth is expected for STEM occupations, which suggests that there will be an increase in labour market opportunities for STEM-educated workers (Diekman, Weisgram and Belanger 2015). However, the extent to which STEM graduates enter into and remain in STEM occupations in Canada is largely unknown. Moreover, if the demand for STEM-educated workers increases, there will also be a rise in concerns about the retention of these workers in STEM occupations.

Increasing women's participation in STEM fields is one way that the growing demand for STEM-educated workers can be met. Greater representation of women in STEM has also been identified as a way to make Canada more competitive in the global economy and fully take advantage of women's skills (Council of Canadian Academies 2015), as well as address the gender pay gap, as these occupations tend to be well paid. However, despite increases in women's educational attainment and participation in scientific occupations over the past several decades (Dionne-Simard, Galarneau and LaRochelle-Côté 2016; Turcotte 2011), women remain underrepresented in STEM fields.

Previous research examining gender differences in STEM is largely focused on the extent to which women obtain educational credentials in STEM fields of study (e.g., Hango 2013; Ferguson 2016) and issues of attrition throughout their training (e.g., Chen 2015; George-Jackson 2011; Maltese and Tai 2011; Miller and Wai 2015; Wall 2019). Although some researchers note that "leaks" in the STEM pipeline can occur at different stages of women's lives, less is known about the loss of women from STEM occupations after they obtain STEM credentials (Blickenstaff 2005; Cech and Blair-Loy 2019; Dasgupta and Stout 2014).

These issues can be addressed with longitudinal data, which make it possible to analyze individuals over time. While some longitudinal analyses have compared the earnings of men and women in STEM and non-STEM occupations (Xu 2015), information about the occupational pathways of STEM graduates is lacking. This is particularly true in the Canadian context, where few researchers have examined the occupational mobility of women with STEM credentials and how their pathways compare with those of men.

This study used data from the longitudinal census files to examine the occupational pathways of men and women with STEM credentials between 2006 and 2016 who were aged 25 to 54 in 2006. Sex-disaggregated statistics were used in a gender-based approach to analyze the occupational stability or mobility of STEM graduates. The following research questions were addressed:

1. What proportion of STEM graduates worked in STEM occupations or non-STEM occupations or were not in the labour force in 2006 and 2016? Was there a gap in the proportion of women and men who worked in STEM occupations in 2006 and, if so, did that gap increase or decrease between 2006 and 2016?
2. Among STEM graduates who were employed in 2006, were certain sociodemographic or educational characteristics associated with a greater likelihood of working in a STEM occupation?
3. What were the occupational pathways of STEM graduates who were employed in both 2006 and 2016 (i.e., persisted in a STEM occupation, exited a STEM occupation, entered a STEM occupation or did not work in a STEM occupation in either year)? Did the occupational pathways of men and women vary?
4. Among STEM graduates who were employed in a STEM occupation in 2006, what proportion moved to a non-STEM occupation by 2016? Were certain sociodemographic

or educational characteristics associated with exiting a STEM occupation or persisting in a STEM occupation?

5. Among STEM graduates who exited a STEM occupation between 2006 and 2016, what were the top STEM occupations that they left and what were the top non-STEM occupations to which they moved?
6. Accounting for sociodemographic and educational differences, was the wage growth of STEM graduates who persisted in STEM occupations between 2006 and 2016 greater than that of their counterparts who moved to non-STEM occupations?

This paper is organized as follows. Section 2 provides an overview of the previous research on STEM graduates and workers. The data and measures are reviewed in Section 3. The study results are presented in Section 4, and Section 5 concludes with a discussion of the findings.

2 The representation of women and men in STEM fields

Although women now account for the majority of university graduates, they are less likely than men to hold a degree in a STEM field of study (Ferguson 2016).¹ According to the 2016 Census, about one-quarter (24.8%) of bachelor's degree holders between the ages of 25 and 54 had studied in a STEM program. Over one-third of men (37.5%) with a bachelor's degree had studied in a STEM field, compared to 15.3% of women with a bachelor's degree. Similar results were found among college graduates: 3 in 10 men (30.0%) had studied in a STEM field, while less than 1 in 10 (6.7%) women had studied in a STEM field.²

Several explanations for women's lower likelihood of selecting a STEM field of study or persisting in it have been advanced, including cultural pressures related to stereotypical gender roles (e.g., parental expectations and peer norms), a lack of self-confidence in STEM-related subjects, a lack of female role models, and preferences and interests (Blickenstaff 2005; Dasgupta and Stout 2014; White and Massiha 2016).

The 2016 Census data also indicate that the specific STEM fields of study differed for men and women. While over half of men with a STEM bachelor's degree studied engineering or engineering technology (52.2%), only one-quarter of women with a STEM degree had studied in this field (25.3%). The majority of women (54.1%) who had a bachelor's degree in a STEM field had studied in science or science technology programs. The difference in the proportion of men and women with a STEM degree who had studied mathematics or computer and information sciences was less pronounced (23.8% of men and 20.6% of women).³

The differences in choice of STEM field of study among men and women may be associated with their likelihood of working in a STEM occupation. Canadian research has shown that among young STEM graduates (aged 25 to 34), men were more likely than women to work in STEM occupations (Statistics Canada 2017a). This was partly attributable to STEM graduates' specific field of study. For example, engineering graduates were more likely than biological science graduates to work in a STEM occupation. Previous research also indicates that young engineering graduates were largely concentrated in engineering occupations, while physical and life science graduates tended to work across a wider range of occupations, many of which were non-STEM occupations⁴ (Frenette and Frank 2017). Therefore, since a higher proportion of women with STEM credentials studied life sciences than men (and, conversely, a higher proportion of male STEM graduates studied engineering than female STEM graduates), the likelihood of working in a STEM occupation is expected to differ between women and men.

Increasing female representation in high-paying occupations has been identified as a way to reduce the gender pay gap (Lemieux and Riddell 2015). Considering that STEM occupations are generally high paying (Xu 2015), gender differences in the likelihood of STEM graduates working in a STEM occupation may have an impact on women's economic well-being. However, previous research has found that the positions held by women in some STEM fields are lower paying than the ones held by their male counterparts (Broyles 2009). Therefore, while increased female representation in STEM occupations may improve women's overall economic standing, they may

1. Ferguson (2016) primarily examined three STEM groups: science and technology, engineering, and mathematics and computer sciences, and—for some analyses—examined fields at the subgroup level (e.g., biological and biomedical sciences, physical sciences).

2. Based on the author's calculations from 2016 Census of Population data table, Catalogue no. 98-400-X2016263 (Statistics Canada 2016). Results represent individuals aged 25 to 54. This age range was selected because it is the same as the one used in this study.

3. These results represent bachelor's degree holders aged 25 to 54 and are based on the author's calculations from a 2016 Census of Population data table, Catalogue no. 98-400-X2016263 (Statistics Canada 2016).

4. For example, the top 10 occupations for women aged 25 to 34 years old who held a bachelor's degree in the physical and life science fields included non-STEM occupations such as administrative officer; secondary school teacher; and health policy researcher, consultant and program officer.

still encounter gender pay differences within these occupations. Furthermore, women who are among the top 1% of earners in Canada were primarily concentrated in health occupations rather than STEM occupations (Richards 2019), indicating that women with STEM credentials may also prosper in non-STEM occupations.

Individuals who work in jobs that are closely related to their field of study have been found to have better career outcomes than those who do not (Xu 2013). Recent Canadian research concluded that over half of young graduates with a bachelor's degree in a STEM field worked in a STEM occupation in 2016 (Statistics Canada 2017b).⁵ This was primarily driven by men, who tend to select fields of study associated with a greater likelihood of working in STEM occupations than women, as discussed above. However, employment in a non-STEM occupation is not necessarily an indication that STEM graduates encountered difficulties in obtaining employment in a STEM occupation. The skills developed within STEM programs can be applied to a range of occupations, which gives STEM graduates many labour market options (Council of Canadian Academies 2015). Additionally, some STEM graduates may work in management-level positions in non-STEM occupations or prefer non-STEM jobs.

Researchers and policy makers have raised concerns about the persistence of women in STEM careers, suggesting that women's employment in STEM occupations is not static over time (Glass et al. 2013; Mavriplis et al. 2010; Mortillaro 2018). Glass et al. (2013) found that women in STEM occupations moved to non-STEM occupations at high rates and generally did not return after leaving. Studies analyzing the employment interruptions of women in STEM occupations found that barriers arose for those who sought to return to STEM occupations later in life. For example, Dasgupta and Stout (2014, 26) noted that the career gaps of women seeking to re-enter STEM occupations may be deemed problematic by potential employers who believe that their STEM-related skills have become "rusty" or outdated. Furthermore, a loss of professional networks may hinder women from returning to STEM careers after time away. However, both women and men may face similar challenges after leaving a STEM occupation.

A report by Engineers Canada and Geoscientists Canada (2016) found that difficulties in retaining workers in STEM fields were often related to career progression obstacles following maternity or parental leaves of absence. However, women are more likely to experience career interruptions because of parenthood and often cite different reasons for leaving their fields than men, including family obligations, a lack of mentoring or guidance, a lack of flexible work hours, and the perception that science- and engineering-oriented workplaces are "unfriendly to women" (Blickenstaff 2005; Dasgupta and Stout 2014; Mavriplis et al. 2010; Preston 2004, 30). Researchers in the United States found that 42% of women left full-time STEM occupations within three years of having their first child, compared with 15% of new fathers (Cech and Blair-Loy 2019). The study also found that both new mothers and new fathers were more likely to move out of STEM occupations than their childless peers, and most did not move back into these occupations when their children reached school age. Additionally, the attrition of new mothers and fathers was not found to be driven by a specific STEM field, suggesting that this "may be a feature of STEM more broadly" (Cech and Blair-Loy 2019, 4).

5. Statistics Canada (2017b) research defines STEM occupations as those assigned to the National Occupational Classification category "natural and applied sciences and related occupations." The classification of STEM occupations used in the current study is largely based on this set of occupations, but also includes related management occupations (e.g., engineering manager, computer and information systems manager). Refer to Appendix Table 1 and Picot and Hou (2018; forthcoming).

3 Data and measures

This study uses the 2006 and 2016 longitudinal census files, which link individuals across the two census years. For this study, only women and men who responded to both the 2006 and 2016 census long-form questionnaires were included in the sample.⁶ As a result, there could be differences between this sample and the general population. To minimize concerns about this limitation, survey weights from the 2006 Census were applied. Descriptive analyses were also conducted to compare key characteristics of the weighted longitudinal sample with the weighted 2006 Census sample. Across most characteristics, the two samples differed by less than 1 percentage point. In particular, differences between the samples were narrow for STEM fields of study, education level, visible minority status, Aboriginal identity and employment in a STEM occupation.⁷

The longitudinal sample was limited to Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree (bachelor's degree or above) in a STEM field of study.⁸ This age range was selected to include people of prime working age over the 10-year period studied.⁹ Furthermore, only those who reported the same level of education in 2006 and 2016 were included to minimize the possibility of including individuals who obtained additional educational credentials in non-STEM programs over this period. These restrictions resulted in a sample size of 48,271 (33,686 men and 14,585 women). Sample restrictions varied across different analytical sections because of the specific questions being addressed. Details about each of these samples are addressed in the results section.

Two key variables in this study are field of study and occupation. Statistics Canada's (2018) STEM field of study classification was used to assign the field of study of each respondent's highest certificate, diploma or degree (in 2006) to a STEM group. Some STEM groups were combined to ensure adequate sample sizes for more detailed descriptive analyses, resulting in four STEM fields: (a) physical and chemical sciences; (b) biological, general and integrated sciences; (c) engineering and engineering technology; and (d) mathematics and computer and information sciences.

The classification of STEM occupations follows Picot and Hou's (2018; forthcoming) work, which provides a consistent categorization of STEM occupations over several census years. Appendix Table 1 provides a detailed list of STEM occupations and their corresponding 2006 National Occupational Classification for Statistics (NOC-S 2006) and 2016 National Occupational Classification (NOC 2016) codes. Generally, this classification includes occupations in the NOC's "natural and applied sciences and related occupations" category and some STEM-related management occupations (e.g., engineering managers).

-
6. The preliminary data analysis looked at respondents of the 2006 and 2016 census long-form questionnaires and the 2011 National Household Survey. Since individuals had to be respondents for all three years, the sample size was markedly reduced for STEM graduates. Cross-tabulations indicated that analyses of certain demographic groups and women in some STEM fields of study would be problematic because of small sample sizes. Therefore, only the 2006 and 2016 longitudinal census files were used in this study to optimize the sample size.
 7. The largest difference between the two samples was for marital status: married and common-law individuals were overrepresented in the longitudinal sample (66.6%), compared with the 2006 Census sample (61.2%). Women were also slightly underrepresented in the longitudinal sample (48.2% vs. 49.6% of the 2006 Census sample), as were immigrants (21.4% of the longitudinal sample vs. 22.4% of the 2006 Census sample). Detailed results are available upon request.
 8. Since trades and apprenticeship programs are aligned with specific occupations rather than fields of study, postsecondary graduates whose highest certificate, diploma or degree was a trades or apprenticeship certificate were excluded from the study.
 9. Additional analysis assessed the feasibility of studying only those aged 25 to 44. See Footnote 17 for a discussion of this analysis.

This study takes a gender-based analytical approach, presenting sex-disaggregated statistics for men and women. These results represent only STEM graduates and do not account for men and women with non-STEM credentials who may be employed in STEM occupations.¹⁰

4 Results

4.1 Description of sample characteristics

The main characteristics of the longitudinal sample are provided in Table 1. Results are presented for two samples. The first includes all STEM graduates, regardless of whether they were employed in 2006 or 2016, and the second includes only STEM graduates who were employed in both 2006 and 2016. Few differences were found between these two samples.

Generally, the majority (7 in 10) of STEM graduates were men, while 3 in 10 were women. Just over three-quarters of the sample were married or in a common-law relationship in 2006. About 17% were single.¹¹ Nearly two-thirds of the sample did not have children younger than 6 in either 2006 or 2016, and about one-third had a young child in either 2006 or 2016. Only 2.1% had children younger than 6 in both years.

One-quarter of respondents reported being a member of a visible minority group, while just over one-third of the sample were immigrants. Compared with men, a slightly higher proportion of women with STEM credentials were immigrants.

A small proportion of STEM graduates identified as a member of an Aboriginal group¹² in the longitudinal sample (just over 1%). Similar proportions of men and women reported being a member of an Aboriginal group.

About 2 in 10 respondents achieved their highest level of education outside Canada. This proportion was slightly higher among women than men (22.8% and 20.1%, respectively). A higher proportion of STEM graduates reported a college diploma or university certificate below the bachelor's level (43.2%) than a bachelor's degree (41.6%) as their highest level of education. However, men were more likely than women to have college-level credentials, while women were more likely to hold a bachelor's degree.

Overall, the largest proportion of STEM graduates had studied engineering or engineering technology (47.9%). However, this was largely driven by men. Over half of male STEM graduates had studied engineering or engineering technology, compared with just under one-quarter of women with STEM credentials. Conversely, women were much more likely to have studied biological, general or integrated sciences than men (37.5% and 12.5%, respectively). About one-quarter of STEM graduates had studied mathematics or computer and information sciences, while less than 1 in 10 had studied physical or chemical sciences.

10. For example, results from the 2016 Census showed that 3% of female arts and humanities graduates aged 25 to 34 and 8% of their male counterparts were employed in natural and applied sciences and related occupations (Statistics Canada 2017b).

11. Changes in marital status between 2006 and 2016 were also studied, and the results showed that the majority of respondents (83.5%) reported the same marital status in both years. Of those whose marital status changed, about 8% went from single to married or common law, and 4.6% went from married or common law to divorced, separated or widowed.

12. In accordance with census terminology, the term "Aboriginal" was used in this study to refer to individuals who identify themselves as First Nations, Métis or Inuit. Because the sample sizes were small, an analysis for each group was not feasible.

Table 1
Key characteristics of the longitudinal sample of STEM graduates

	Sample including all STEM graduates			Sample including only STEM graduates employed in 2006 and 2016		
	Overall	Men	Women	Overall	Men	Women
	percent			percent		
Sex						
Female	30.2	...	100.0	28.0	...	100.0
Male	69.8	100.0	...	72.0	100.0	...
Age group (2006)						
25 to 34	30.0	28.4	33.8	31.7	30.2	35.5
35 to 44	38.8	38.8	38.9	40.8	40.7	41.0
45 to 54	31.2	32.8	27.3	27.5	29.1	23.5
Marital status (2006)						
Single, never married	17.1	17.3	16.6	17.1	16.8	17.7
Married or common law	77.5	78.3	75.4	77.8	79.1	74.4
Separated, divorced or widowed	5.5	4.4	8.0	5.1	4.1	7.9
Immigrant status						
Canadian-born	65.8	66.7	63.6	66.3	66.7	65.2
Immigrant	34.2	33.3	36.5	33.7	33.3	34.8
Aboriginal identity						
Does not identify as member of an Aboriginal group	98.9	99.0	98.7	98.9	99.0	98.7
Identifies as member of an Aboriginal group	1.1	1.0	1.3	1.1	1.0	1.3
Visible minority status						
Not a visible minority	74.8	75.5	73.2	75.2	75.5	74.4
Visible minority	25.2	24.6	26.8	24.9	24.6	25.6
Presence of children younger than 6						
Had children younger than 6 in 2006 and 2016	2.1	2.1	2.1	2.1	2.2	1.9
Had children younger than 6 in 2006, not in 2016	22.0	21.8	22.3	22.9	23.3	22.0
Had children younger than age 6 in 2016, not in 2006	10.6	10.9	9.8	11.4	11.7	10.7
Did not have children younger than 6 in 2006 or 2016	65.3	65.1	65.8	63.5	62.8	65.4
Highest certificate, diploma or degree						
College, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree	43.2	45.3	38.2	42.6	44.6	37.6
Bachelor's degree	41.6	40.2	45.0	41.7	40.5	44.8
University degree above a bachelor's degree	15.2	14.5	16.8	15.7	14.9	17.6
Location of postsecondary study						
Canada	79.1	79.9	77.2	79.7	79.9	79.2
Outside Canada	20.9	20.1	22.8	20.3	20.1	20.8
STEM field of study						
Physical and chemical sciences	7.0	6.3	8.6	6.9	6.2	8.5
Biological, general and integrated sciences	20.0	12.5	37.5	19.7	12.5	38.0
Engineering and engineering technology	47.9	58.2	24.1	48.6	58.1	24.3
Mathematics and computer and information sciences	25.1	23.0	29.8	24.9	23.2	29.2
Area of residence (2006)						
Newfoundland and Labrador	1.1	1.1	1.2	1.2	1.1	1.3
Prince Edward Island	0.3	0.3	0.4	0.3	0.3	0.4
Nova Scotia	2.5	2.4	2.8	2.5	2.4	2.9
New Brunswick	1.9	2.0	1.8	2.0	2.0	2.0
Quebec	23.3	23.8	22.0	23.2	23.6	22.3
Ontario	44.3	43.8	45.3	44.1	43.8	44.7
Manitoba	2.6	2.6	2.5	2.6	2.6	2.6
Saskatchewan	1.7	1.7	1.8	1.8	1.8	1.9
Alberta	11.4	11.6	10.8	11.5	11.8	10.7
British Columbia	10.7	10.5	11.1	10.7	10.6	11.1
Territories	0.2	0.2	0.3	0.2	0.2	0.3
			number			
Sample size	48,271	33,686	14,585	42,142	30,312	11,830
... not applicable						

Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree or a university degree in a STEM field of study and reported the same level of education in 2006 and 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

4.2 Proportion of STEM graduates working in STEM occupations, 2006 and 2016

This section presents the proportion of STEM graduates in the longitudinal sample who worked in STEM occupations, non-STEM occupations, or who were not in the labour force.¹³ Results for both 2006 and 2016 are reported. For this analysis, the sample included all STEM graduates regardless of their employment status in 2006 and 2016, allowing for potential movement into and out of the labour force.

Overall, just over 4 in 10 STEM graduates in the longitudinal sample were employed in a STEM occupation in 2006 (41.1%; Chart 1). A smaller proportion (35.8%) worked in a STEM occupation in 2016, representing a 12.7% decrease between 2006 and 2016.

There were notable differences in the proportion of men and women with STEM credentials working in STEM occupations (Chart 1).¹⁴ While nearly half of male STEM graduates worked in a STEM occupation in 2006 (46.9%), less than 3 in 10 women with STEM credentials worked in similar occupations (27.6%). Both women and men were less likely to be employed in a STEM occupation in 2016—women experienced a 17.4% decrease, while men experienced an 11.5% decrease.¹⁵ Generally, the gap between men and women was similar between 2006 and 2016 (about 19 percentage points).

Detailed information about the occupations of STEM graduates is presented in Chart 2. In both 2006 and 2016, half of male STEM graduates worked in non-STEM occupations.¹⁶ In comparison, over 6 in 10 women with STEM credentials worked in non-STEM occupations in the two years. Overall, a higher proportion of men than women had managerial occupations in both 2006 and 2016. Moreover, women with STEM credentials were more likely than their male counterparts to be unemployed or not in the labour force.¹⁷

13. Additional analyses were conducted to determine whether the employment differences between men and women with STEM credentials were similar to those between men and women with non-STEM credentials. The results showed statistically significant differences between men and women with STEM credentials across the three employment categories examined (employed, unemployed and not in the labour force): men were more likely than women to be employed and less likely than women to be unemployed or not in the labour force. However, while men with non-STEM credentials were more likely than their female counterparts to be employed and less likely to not be in the labour force, similar proportions of men and women with non-STEM credentials were unemployed.

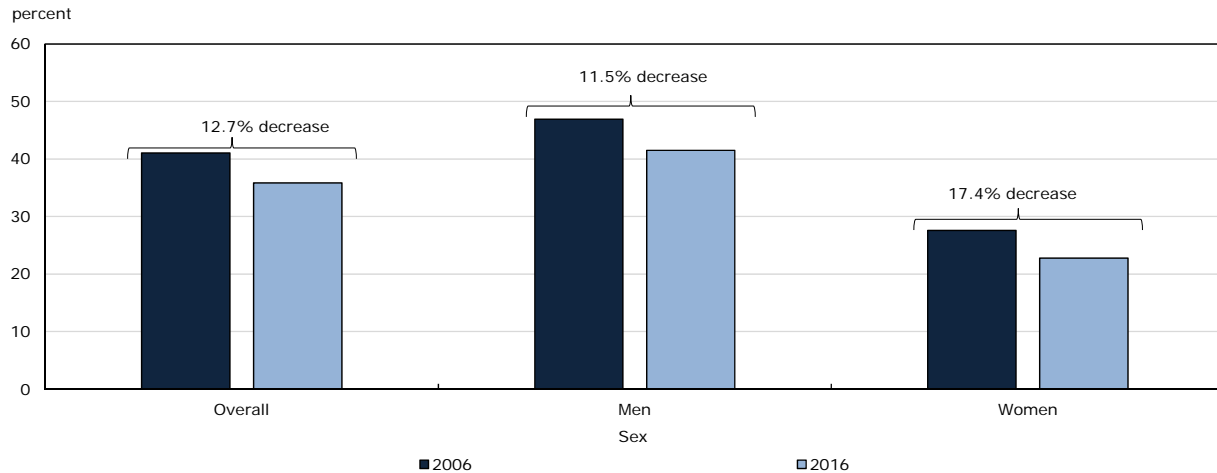
14. These differences were statistically significant at $p < 0.001$. Respondents who were unemployed or not in the labour force were included in these calculations.

15. These results represent the percentage change between 2006 and 2016, not the difference in percentage points between the two years.

16. This is determined by summing the percentage of men working in non-STEM, non-management occupations and non-STEM, management occupations.

17. Since older individuals may have retired by 2016, additional analyses were conducted that included only those aged 25 to 44 in 2006. These results showed smaller proportions of men and women who were unemployed or not in the labour force in 2016 (3.0% and 8.6%, respectively). Additionally, the proportion of women working in a STEM occupation in 2006 was 2.1 percentage points higher among 25- to 44-year-olds than among 25- to 54-year-olds. The proportion of men working in a STEM occupation was 2.8 percentage points higher for those aged 25 to 44 than for those aged 25 to 54. However, the regressions done on the likelihood of working in a STEM occupation (Table 2) and the likelihood of exiting a STEM occupation (Table 3) provided similar conclusions for both age groups. These results—combined with potential sample size issues for more detailed levels of analysis—resulted in a decision to use the sample of individuals aged 25 to 54 for this study.

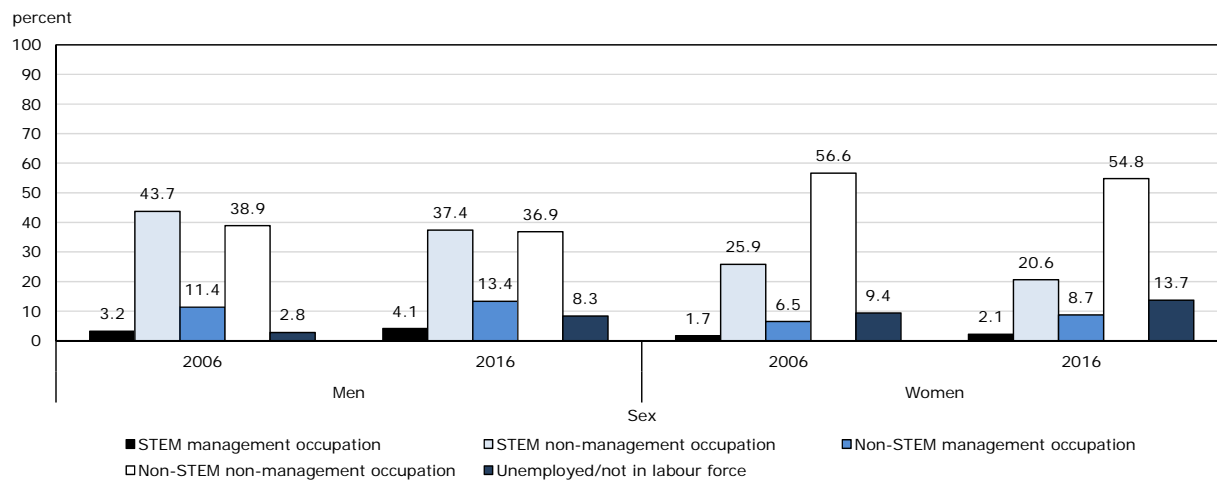
Chart 1
Proportion of STEM graduates employed in a STEM occupation, 2006 and 2016



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study and reported the same level of education in 2006 and 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Chart 2
Occupational distribution of STEM graduates by sex, 2006 and 2016



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study and reported the same level of education in 2006 and 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

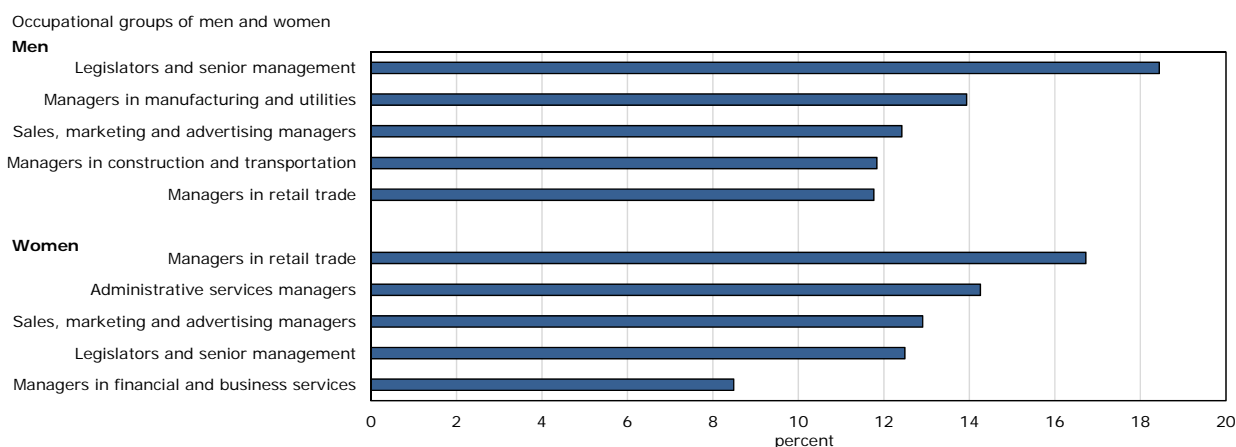
Female and male STEM graduates who worked in non-STEM occupations in 2006 were generally in similar occupational groups (Chart 3).¹⁸ Three of the top five occupational groups were the same for both women and men: legislators and senior management; sales, marketing and advertising managers; and managers in retail trade. However, a higher proportion of men than women worked in the legislators and senior management group (18.4% and 12.5%, respectively), while a higher proportion of women than men worked in the managers in retail trade group (16.7% and 11.8%, respectively).

Some differences in women's and men's non-STEM occupations were also observed. For example, while administrative services managers and managers in financial and business services were among the top five occupational groups of women working in non-STEM occupations, they were not among the top occupational groups for their male counterparts

18. Although results are presented only for occupational groups in 2006, the occupational groups of STEM graduates working in non-STEM occupations in 2016 were similar.

(Chart 3). About one-quarter of male STEM graduates in non-STEM occupations had worked as managers in manufacturing and utilities or as managers in construction and transportation, which were not in the top occupational groups of women employed in non-STEM occupations.

Chart 3
Top five occupational groups of STEM graduates who were employed in non-STEM occupations by sex, 2006



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; and were employed in non-STEM occupations in 2006.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

To determine whether sociodemographic and educational characteristics were associated with the likelihood of working in a STEM occupation in 2006,¹⁹ ordinary least squares (OLS) regression models were employed.²⁰ The variables entered in the model include age group in 2006 (25 to 34, 35 to 44 or 45 to 54); marital status in 2006 (single; married or common law; or divorced, separated or widowed); binary variables for immigrant status, Aboriginal identity and visible minority status; number of children younger than 6 in 2006 (none, one, two, or three or more); highest certificate, diploma or degree in 2006 (college diploma or university certificate below a bachelor's degree, bachelor's degree, or university degree above a bachelor's degree); STEM field of study (physical and chemical sciences; biological, general and integrated sciences; engineering and engineering technology; or mathematics and computer and information sciences); location of study (within Canada or outside Canada); and province or territory²¹ of residence in 2006. For these models, only individuals who were employed in 2006 were included in the sample.

Results for the regression models are presented in Table 2. Among both men and women, STEM graduates in older age groups were less likely than their counterparts aged 25 to 34 to work in a

19. A regression model that examined the likelihood of working in a STEM occupation in 2016 was also run. Since these results were largely similar to those from the 2006 model, they are not presented in this study. Some differences in the provincial results were observed between the 2006 and 2016 models. In the 2016 model for men, results for Nova Scotia, Manitoba, Saskatchewan and British Columbia were not statistically significant. In the 2016 model for women, results for Nova Scotia and New Brunswick were not statistically significant.

20. Although the outcome is binary, OLS regression models were used for ease of interpretation. Probit and logit models were run to verify whether the OLS models were appropriate to use. The marginal probabilities produced by the probit and logit models indicated that there were only slight differences between the results of these models and the OLS models and that the conclusions drawn from the OLS models remained the same, but with one exception—in the logit model for men, the result for British Columbia was not statistically significant.

21. Because the sample sizes were small, Yukon, Northwest Territories and Nunavut were grouped together.

STEM occupation.²² Furthermore, men and women who identified as visible minorities were less likely than their counterparts who did not identify as a minority to work in a STEM occupation.

Differences between men and women with STEM credentials were observed in the relationship between Aboriginal identity and the likelihood of working in a STEM occupation. While Aboriginal men with STEM credentials were less likely than their non-Aboriginal counterparts to be employed in a STEM occupation in 2006, there was no statistically significant difference between Aboriginal women and non-Aboriginal women.

The relationship between the number of children younger than age 6 and the likelihood of working in a STEM occupation also differed between women and men. Men who had one or two children younger than 6 were more likely than men with no young children to work in a STEM occupation. Similarly, women with one child younger than 6 were more likely to be employed in a STEM occupation than women with no young children. However, women who had three or more children younger than 6 were less likely than those with no young children to be employed in a STEM occupation.

Level of education also mattered. Compared with bachelor's degree holders, STEM graduates who held a college diploma or a university certificate below the bachelor's level were less likely to be employed in a STEM occupation, while those with a university degree above a bachelor's degree were more likely to work in a STEM occupation. This was true for both men and women. Furthermore, men and women who obtained their STEM credentials in Canada were more likely than their counterparts who studied outside Canada to work in a STEM occupation. This may be an indication of a preference among STEM employers for Canadian-educated workers.

22. This is in line with previous studies of STEM workers that indicate that younger STEM graduates are more likely than older STEM graduates to have STEM occupations (Landivar 2013). This may be partly attributable to individuals moving into management positions as they progress in their careers.

Table 2
Ordinary least squares regression of the likelihood of working in a STEM occupation in 2006 on sociodemographic and educational factors, STEM graduates who were employed in 2006

	Men		Women	
	coefficient	standard error	coefficient	standard error
Age group (2006) (reference group: 25 to 34)				
35 to 44	-0.033 ***	0.007	-0.028 **	0.010
45 to 54	-0.074 ***	0.008	-0.069 ***	0.012
Marital status (2006) (reference group: married or common law)				
Single or never married	-0.003	0.009	-0.019	0.012
Separated, divorced or widowed	-0.025 †	0.014	-0.021	0.016
Number of children younger than 6 (2006) (reference group: none)				
One	0.024 **	0.009	0.023 †	0.013
Two	0.022 †	0.012	0.001	0.019
Three or more	0.000	0.034	-0.114 *	0.053
Visible minority status (reference group: not a visible minority)				
	-0.062 ***	0.009	-0.025 †	0.014
Aboriginal identity (reference group: does not identify as member of an Aboriginal group)				
	-0.085 **	0.027	-0.045	0.036
Immigrant status (reference group: Canadian-born)				
	0.016	0.010	0.019	0.015
Highest certificate, diploma or degree (reference group: bachelor's degree)				
College, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree	-0.177 ***	0.007	-0.126 ***	0.010
University degree above a bachelor's degree	0.031 **	0.009	0.046 ***	0.013
Location of study (reference group: outside Canada)				
	0.106 ***	0.010	0.140 ***	0.014
STEM field of study (reference group: engineering and engineering technology)				
Physical and chemical sciences	-0.080 ***	0.013	-0.101 ***	0.018
Biological, general and integrated sciences	-0.316 ***	0.009	-0.315 ***	0.011
Mathematics and computer and information sciences	0.129 ***	0.007	-0.037 **	0.013
Area of residence (2006) (reference group: Ontario)				
Newfoundland and Labrador	0.015	0.028	-0.097 **	0.032
Prince Edward Island	-0.011	0.054	0.013	0.067
Nova Scotia	-0.059 **	0.019	-0.080 **	0.024
New Brunswick	-0.007	0.021	-0.080 **	0.027
Quebec	0.011	0.008	0.052 ***	0.012
Manitoba	0.040 *	0.019	0.050 †	0.027
Saskatchewan	0.039 †	0.023	0.084 *	0.034
Alberta	0.091 ***	0.010	0.040 **	0.014
British Columbia	0.017 †	0.010	0.002	0.014
Territories	0.038	0.054	0.109	0.073

* significantly different from reference category (p < 0.05)

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

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

† significantly different from reference category (p < 0.10)

Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree or a university degree in a STEM field of study, reported the same level of education in 2006 and 2016, and were employed in 2006. The sample size was 32,719 for men and 3,227 for women.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Men and women who studied physical or chemical sciences or biological, general or integrated sciences were less likely to be working in STEM occupations than their counterparts who studied engineering or engineering technology. However, differences between women and men were found for mathematics and computer and information science graduates. Men who studied mathematics or computer and information sciences were more likely than men who studied engineering or engineering technology to be working in a STEM occupation. By comparison, women who studied mathematics or computer and information sciences were less likely to be

employed in a STEM occupation than women who had studied engineering or engineering technology.

While the results presented in this section provide an overview of the occupational attainment of STEM graduates in 2006 and 2016, different factors may play a role in the proportion of individuals working in STEM occupations in each of the two years. For example, while some individuals leave STEM occupations, others may enter from non-STEM occupations. To better understand the occupational changes of STEM graduates, the remaining sections concentrate on the pathways of STEM graduates who were employed in both 2006 and 2016.

4.3 Occupational pathways of STEM graduates

This section examines only the STEM graduates who reported an occupation in both 2006 and 2016. Since the primary goal of this study is to understand the occupational changes of STEM graduates, focusing on this group provides insight into the pathways of individuals who had an occupation in both years.

Descriptive analyses are presented for four occupational pathways: (a) employed in a STEM occupation in both 2006 and 2016 (persisted in STEM), (b) employed in a STEM occupation in 2006 and employed in a non-STEM occupation in 2016 (exited STEM), (c) employed in a non-STEM occupation in 2006 and employed in a STEM occupation in 2016 (entered STEM), and (d) worked in a non-STEM occupation in 2006 and 2016 (never in STEM²³).

The occupational pathways of men and women with STEM credentials differed.²⁴

Generally, a higher proportion of men (35.9%) than women (20.2%) worked in a STEM occupation in both 2006 and 2016 (persisted in STEM, Chart 4). Notably, just over 6 in 10 women with STEM credentials did not work in a STEM occupation in either year, compared with about 4 in 10 men (never in STEM, Chart 4). The differences observed in the proportion of men and women who exited or entered STEM occupations between 2006 and 2016 were less pronounced.²⁵

The occupational pathways of STEM graduates also varied by field of study. Among men, about half of mathematics and computer and information science graduates and just over one-third of engineering and engineering technology graduates persisted in a STEM occupation between 2006 and 2016 (Chart 5).²⁶ Notably, about two-thirds of men who studied biological, general or integrated sciences did not have a STEM occupation in either 2006 or 2016. Across STEM fields, men who studied mathematics or computer and information sciences had the lowest proportion of graduates who had never worked in a STEM occupation (28.9%).

The highest proportion of women who persisted in a STEM occupation between 2006 and 2016 was for engineering and engineering technology graduates (30.7%; Chart 6). Over one-quarter of women who studied mathematics or computer and information sciences also persisted in STEM occupations over the 10-year period. Among women who studied biological, general or integrated

23. Although it is possible that an individual worked in a STEM occupation at some point between 2006 and 2016, this information was not available in the dataset used for this study. Therefore, the term “never in STEM” is used solely in reference to occupations in 2006 and 2016.

24. The differences discussed in this section are statistically significant at $p < 0.05$, unless otherwise stated.

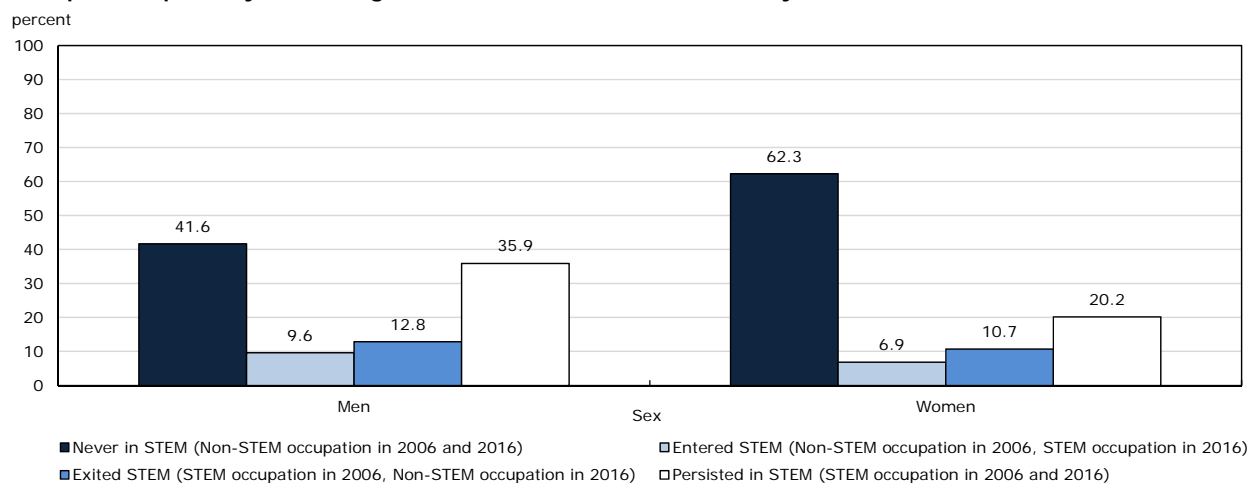
25. The higher proportions of men who persisted in or exited STEM occupations were partially driven by the higher proportion of men who had a STEM occupation in 2006.

26. According to the results for graduates who studied in engineering fields, 40.8% of men were never in STEM occupations. However, earlier research (Statistics Canada 2017a) indicated a higher rate of employment in engineering occupations among young bachelor’s degree holders who studied engineering. This difference may be attributable to the fact that this study includes graduates whose highest levels of education are both below and above the bachelor’s level, as well as the fact that the age range is much wider. The inclusion of older graduates is likely to have an influence on these levels because older STEM graduates are less likely than younger STEM graduates to be employed in STEM occupations (Landivar 2013).

sciences, less than 1 in 10 had a STEM occupation in both 2006 and 2016, while over three-quarters never worked in a STEM occupation.²⁷ More than half of women who studied physical or chemical sciences or mathematics or computer and information sciences did not have a STEM occupation in either 2006 or 2016.

Overall, women from all four STEM fields were less likely than their male counterparts to persist in STEM occupations. They were also more likely than men who studied in the same STEM field to have never worked in a STEM occupation. This was particularly noticeable among men and women who studied mathematics or computer and information sciences. However, similar proportions of men and women with STEM credentials in physical or chemical sciences exited a STEM occupation between 2006 and 2016.²⁸

Chart 4
Occupational pathways of STEM graduates between 2006 and 2016, by sex



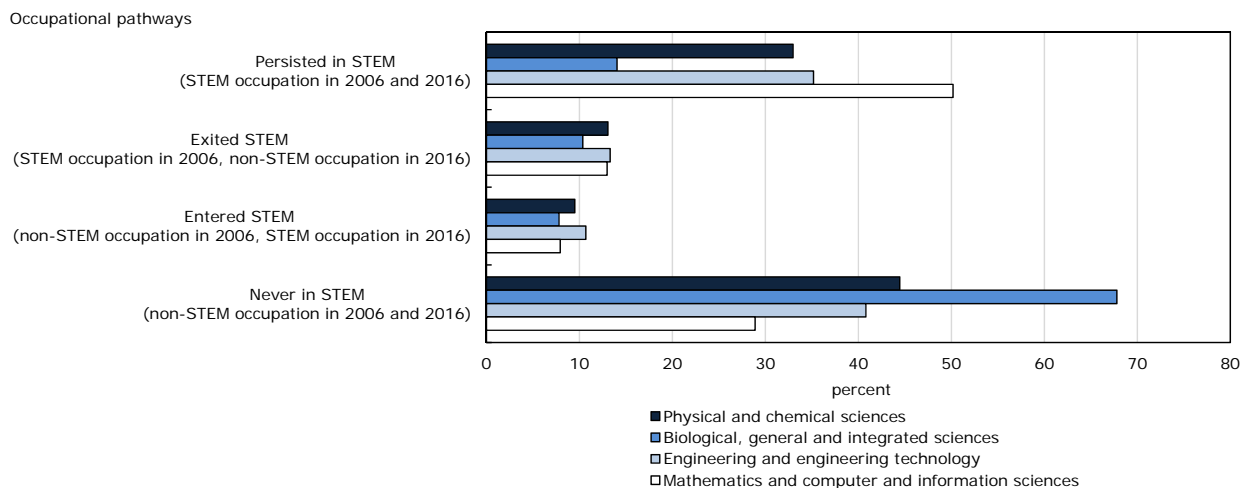
Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; and were employed in 2006 and 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

27. However, many of these women were employed in health-related occupations relevant to their science backgrounds. About one-quarter of women who studied biological, general or integrated sciences and were not employed in a STEM occupation in either 2006 or 2016 worked in occupational groups such as medical technologists and technicians; physicians, dentists and veterinarians; and assisting occupations in support of health services. Additionally, about 12% of these women worked as university professors or assistants or as secondary and elementary school teachers.

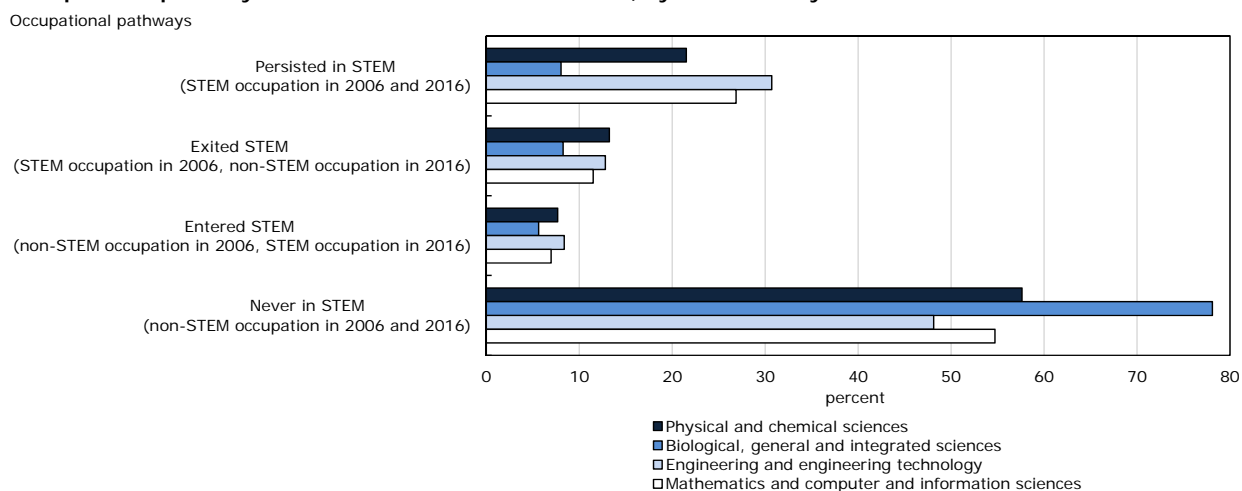
28. Additional analyses were conducted to determine how the rates of STEM occupation exits change when all individuals who moved into a management occupation by 2016 were excluded from the sample. These results indicated lower rates of STEM occupation exits. For example, the proportion of men who exited a STEM occupation decreased by between 4 and 6 percentage points (the highest decrease was for biology and engineering graduates, while the lowest decrease was for mathematics and computer and information science graduates). By comparison, the proportion of women who exited a STEM occupation decreased by between 2 and 5 percentage points when those who moved to management occupations were excluded (the highest decrease was for engineering graduates, while the lowest decrease was for mathematics and computer and information science graduates).

Chart 5
Occupational pathways of men with STEM credentials, by field of study



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; and were employed in 2006 and 2016.
Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Chart 6
Occupational pathways of women with STEM credentials, by field of study



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; and were employed in 2006 and 2016.
Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

4.4 Factors associated with STEM graduates exiting a STEM occupation

While the previous section provides insight into the occupational pathways of STEM graduates, this section focuses on STEM graduates who were employed in a STEM occupation in 2006 and had either persisted in or exited a STEM occupation by 2016.

In addition to providing descriptive information on the occupational pathways of these STEM graduates, this section presents OLS regression results to determine whether certain sociodemographic and educational characteristics were associated with the likelihood of exiting

a STEM occupation between 2006 and 2016.²⁹ For these models, the same set of sociodemographic and educational variables used in the regression model described in Section 4.2 (Table 2) was analyzed, except the variable for the number of young children. For the models presented in this section, a variable was created to account for potential changes in the presence of young children between 2006 and 2016. This variable includes the following categories: children younger than 6 in both 2006 and 2016, children younger than 6 in 2006 only, children younger than 6 in 2016 only, and no children younger than 6 in 2006 or 2016.³⁰

The occupational pathways of STEM graduates who were employed in a STEM occupation in 2006 are presented in Chart 7.³¹ The majority of men and women who were employed in a STEM occupation in 2006 persisted in STEM occupations. However, women were more likely than men to have exited a STEM occupation between 2006 and 2016. Just over one-third of women (34.7%) who were employed in a STEM occupation in 2006 had moved to a non-STEM occupation 10 years later, while about one-quarter of men (26.4%) followed the same occupational pathway.³²

Chart 8 shows the proportion of women and men with STEM credentials who exited a STEM occupation by field of study. Generally, a higher proportion of women than men exited a STEM occupation across all STEM fields. The gap was widest among women and men who studied physical or chemical sciences (38.1% and 28.4%, respectively). The narrowest gap was between women and men who studied engineering or engineering technology; however, the difference in exit rates between male and female engineering graduates was not statistically significant.

The multivariate models presented in Table 3 indicate that age was associated with the likelihood of men and women exiting STEM occupations. Generally, men aged 35 to 44 and women aged 45 to 54 were less likely to exit STEM occupations than their younger (25 to 34) counterparts. However, other sociodemographic characteristics, such as Aboriginal identity, immigrant status and visible minority status, did not show statistically significant associations with exiting a STEM occupation for men or women.

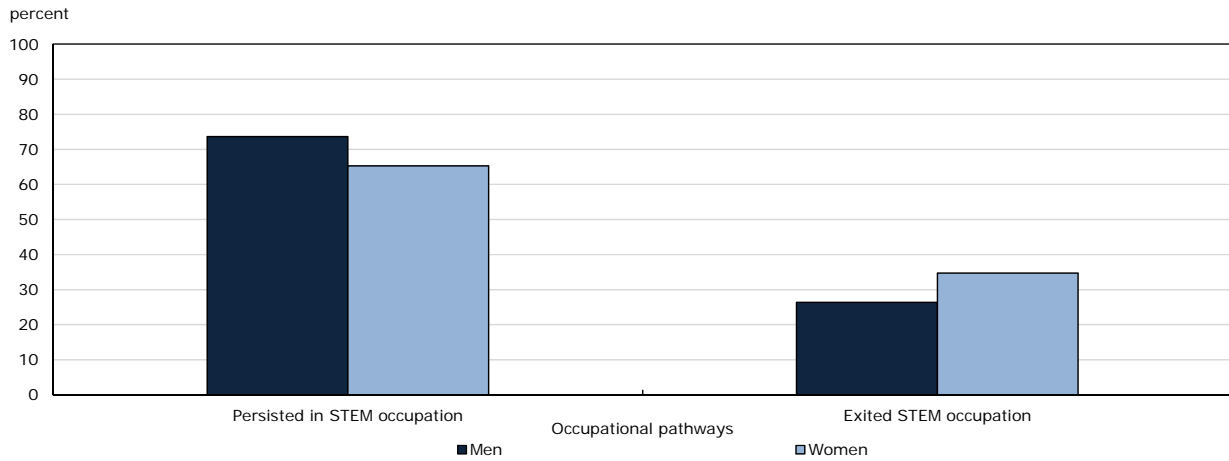
29. Similar to the OLS models discussed above, the outcome variable for this model was binary. Probit and logit models were also run to determine the suitability of the OLS model. Differences between the average partial effects of these models and the OLS models were small, and the conclusions drawn from the OLS models remained the same, but with one exception—in the logit model for women, the coefficient for Prince Edward Island was not statistically significant.

30. This is a derived variable that accounts for data reported in both 2006 and 2016 regarding the presence of children aged 0 to 5 in a census family.

31. Additional analysis was conducted that included STEM graduates who had a STEM occupation in 2006, but had moved out of the labour force by 2016. Generally, these results showed that among individuals who worked in a STEM occupation in 2006, women were more likely than men to have left the labour force by 2016 (9.1% and 6.4%, respectively). These results are presented in Appendix Chart A-1.

32. This difference was statistically significant at $p < 0.001$.

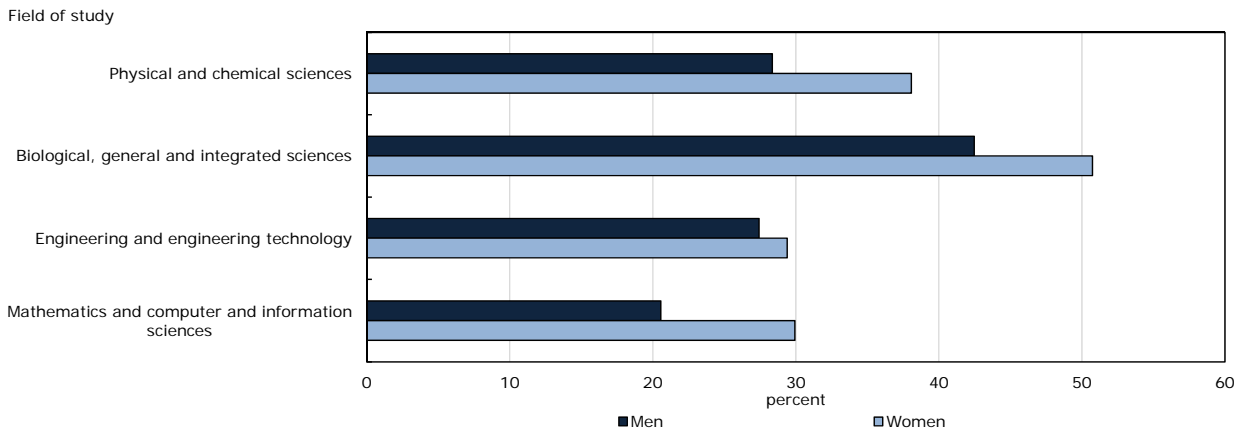
Chart 7
Occupational pathways of STEM graduates who were employed in STEM occupations in 2006, by sex



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; had a STEM occupation in 2006; and were employed in 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Chart 8
Proportion of STEM graduates who exited a STEM occupation between 2006 and 2016, by field of study and sex



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; had a STEM occupation in 2006; and were employed in 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

The previous literature suggests that women's occupational pathways may be associated with family obligations, such as caring for young children (e.g., Xu 2015). Interestingly, having children younger than 6 was not significantly associated with the likelihood of women or men exiting STEM occupations. However, marital status mattered. Single women were less likely to exit a STEM occupation between 2006 and 2016 than women who were married or in a common law relationship. Men who were separated, divorced or widowed were more likely to exit a STEM occupation than their married or common law counterparts.

Since this section focuses only on those who were employed in a STEM occupation in 2006, selection bias may affect the results for the presence of young children variable. For example, as the results in Table 2 showed, women with three or more young children were less likely to be employed in a STEM occupation in 2006 than women with no young children. Therefore, it is possible that some women with young children self-selected out of STEM occupations to begin with.³³ As a result, the potential influence of the presence of young children may be minimized in this set of results.

With respect to education, men and women with a college diploma or university certificate below the bachelor's level were more likely to exit a STEM occupation than their counterparts with a bachelor's degree (Table 3). Field of study was also an important factor in graduates' persistence in STEM occupations. Similar to the descriptive results, men and women who studied physical or chemical sciences or biological, general or integrated sciences were more likely to exit a STEM occupation than their counterparts who studied engineering or engineering technology. However, differences were observed between women and men who studied mathematics or computer and information sciences. Men who studied in these fields were less likely to exit STEM occupations than men who studied engineering or engineering technology. In contrast, there was no statistically significant difference in the likelihood of exiting a STEM occupation between women who studied mathematics or computer and information sciences and women who studied engineering or engineering technology.

One question that arises regarding STEM graduates who left STEM occupations is whether they were concentrated in particular STEM occupations prior to their exit. Moreover, because of a lack of longitudinal data with occupational information, previous studies do not provide much information about the non-STEM occupations to which they moved. Charts 9 and 10 show the most common STEM and non-STEM occupations of men and women who worked in STEM occupations in 2006 and moved to a non-STEM occupation by 2016.

The top two STEM occupational groups in 2006 for individuals who exited STEM occupations were the same for both men and women: information systems analysts and consultants, and computer programmers and interactive media developers (Chart 9).³⁴ Among men who exited STEM occupations, about 1 in 10 worked as either electrical and electronics engineering technologists or civil engineers in 2006. Biologists and related scientists, chemical technologists and technicians, and chemists were also among the top occupational groups that female STEM graduates exited.

33. Generally, researchers have found that having preschool-age children is associated with a decline in women's labour force participation, although the magnitude of the effect of having young children on a woman's decision to work has decreased over time (Chaykowski and Powell 1999; Herrmann and Machado 2012). Furthermore, Dan (2010, 2) found that women self-select out of "risky" occupations, which are characterized by high displacement rates, higher earnings and a higher depreciation of human capital while in non-employment.

34. These results may be attributable to the fact that more people were working in these occupations to begin with. At the minor group (three-digit) level of the NOC—which is broader—the results showed that 22.5% of men who had left a STEM occupation were employed in computer and information systems professions, compared with 29.0% of women. These rates were noticeably higher than the occupational groups with the second-highest exit rates (civil, mechanical, electrical and chemical engineers for men and life science professionals for women).

The top five non-STEM occupational groups in which STEM “leavers” worked in 2016 are presented in Chart 10.³⁵ Just over 2 in 10 women moved into either specialized middle management occupations or professional occupations in law and social, community and government services. Professional occupations in business and finance, as well as administrative and financial supervisors and administrative occupations, were also among the top occupations of women who exited STEM occupations. About 2 in 10 men moved into middle management occupations in trades, transportation, production and utilities, or into specialized middle management occupations, while 7.5% of men moved into senior management occupations.

Additional results showing the top five occupational groups of men and women who exited STEM occupations are presented in Appendix Table 2 by field of study. Some differences were observed across STEM fields. For example, senior management occupations was one of the top five occupational groups to which men moved across all STEM fields, but was not among the top five for women. Conversely, office support occupations was in the top five occupational groups for women who studied physical or chemical sciences, engineering or engineering technology, or mathematics or computer and information science programs, but was not in the top five for men. The results also indicated that many women who studied physical or chemical sciences or biological, general or integrated sciences moved into professional occupations in education services.

35. Because individuals who exited STEM occupations were spread across numerous non-STEM occupations, NOC major groups (two-digit codes) were used to address the issue of small sample sizes.

Table 3

Ordinary least squares regression of the likelihood of STEM graduates exiting a STEM occupation on sociodemographic and educational characteristics, men and women who held a STEM occupation in 2006 and were employed in 2016

	Men		Women	
	coefficient	standard error	coefficient	standard error
Age group (2006) (reference group: 25 to 34)				
35 to 44	-0.019 †	0.010	-0.030	0.022
45 to 54	-0.018	0.013	-0.072 **	0.028
Marital status (2006) (reference group: married or common law)				
Single or never married	-0.009	0.011	-0.043 †	0.024
Separated, divorced or widowed	0.041 †	0.022	-0.016	0.035
Presence of children younger than 6 (reference group: did not have children younger than 6 in 2006 or 2016)				
Had children younger than 6 in 2006 and 2016	-0.0003	0.027	0.048	0.063
Had children younger than 6 in 2006, not in 2016	0.008	0.011	0.001	0.024
Had children younger than 6 in 2016, not in 2006	-0.007	0.013	-0.030	0.030
Visible minority status (reference group: not a visible minority)	-0.009	0.012	-0.029	0.027
Aboriginal identity (reference group: does not identify as member of Aboriginal group)	0.021	0.043	0.013	0.083
Immigrant status (reference group: Canadian-born)	0.008	0.014	0.017	0.030
Highest certificate, diploma or degree (reference group: bachelor's degree)				
College, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree	0.098 ***	0.009	0.052 *	0.021
University degree above a bachelor's degree	-0.018	0.012	-0.008	0.024
Location of study (reference group: outside Canada)	-0.016	0.013	0.016	0.029
STEM field of study (reference group: engineering and engineering technology)				
Physical and chemical sciences	0.040 *	0.018	0.093 **	0.033
Biological, general and integrated sciences	0.183 ***	0.019	0.223 ***	0.026
Mathematics and computer and information sciences	-0.079 ***	0.009	-0.004	0.021
Area of residence (in 2006) (reference group: Ontario)				
Newfoundland and Labrador	0.0003	0.038	0.086	0.096
Prince Edward Island	0.032	0.083	-0.308 **	0.116
Nova Scotia	-0.023	0.029	0.020	0.066
New Brunswick	0.033	0.031	0.059	0.073
Quebec	0.009	0.011	-0.023	0.023
Manitoba	-0.004	0.025	-0.074	0.053
Saskatchewan	0.005	0.031	0.035	0.065
Alberta	-0.023 †	0.012	-0.047 †	0.028
British Columbia	-0.020	0.013	-0.045	0.031
Territories	0.096	0.090	-0.003	0.140

* significantly different from reference category (p < 0.05)

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

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

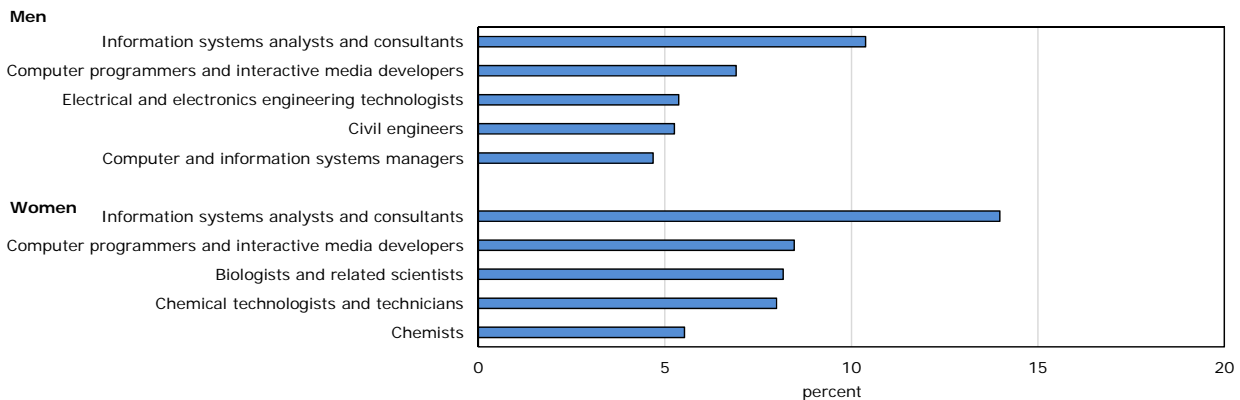
† significantly different from reference category (p < 0.10)

Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; had a STEM occupation in 2006; and were employed in 2016. The sample size was 14,659 for men and 3,597 for women.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Chart 9
Top STEM occupations in 2006 from which men and women with STEM credentials who exited STEM occupations moved

STEM occupations of men and women

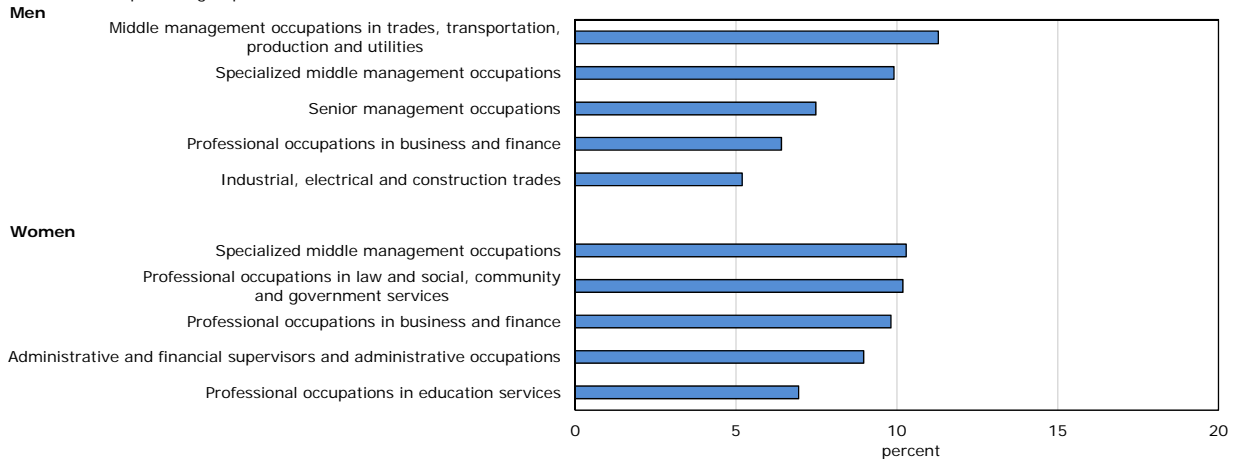


Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; had a STEM occupation in 2006; and had a non-STEM occupation in 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Chart 10
Top non-STEM occupational groups to which men and women with STEM credentials who exited STEM occupations moved, 2016

Non-STEM occupational groups of men and women



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; had a STEM occupation in 2006; and had a non-STEM occupation in 2016.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

4.5 An examination of the earnings of STEM graduates: Does persisting in a STEM occupation pay off?

Studies comparing the earnings of postsecondary graduates by field of study found that STEM graduates earn more than non-STEM graduates (e.g., Hango 2013; Statistics Canada 2017a). However, graduates of some STEM fields work in higher-paying jobs than graduates of other STEM fields (Frenette and Frank 2016). Graduates working in STEM sectors have also been found to earn more than those working in other types of occupations (Caranci, Judge and Kobelak 2017). While these results suggest a general earnings advantage for STEM graduates, little is known about whether their persistence in a STEM occupation is positively associated with greater wage growth than their peers who left STEM occupations.

The primary purpose of the results presented in this section is to determine whether STEM graduates who persisted in a STEM occupation between 2006 and 2016 experienced greater wage³⁶ growth than their counterparts who had moved to a non-STEM occupation by 2016, after accounting for their differences in sociodemographic and educational characteristics. For this part of the analysis, only STEM graduates who had a STEM occupation in 2006, were employed full year, full time³⁷ in both 2006 and 2016, and had positive wages in both 2006 and 2016 were included in the sample.

The dependent variable for this model measures the difference in respondents' log wages between 2006 and 2016 (i.e., 2016 log wages minus 2006 log wages). The independent variables for this model include age group; marital status; presence of children younger than 6 in 2006; visible minority status; Aboriginal identity status; immigrant status; highest certificate, diploma or degree; STEM field of study; province or territory of birth (those born outside Canada are identified as a separate group);³⁸ and a binary variable that identifies whether the respondent persisted in or exited a STEM occupation between 2006 and 2016.

Regression results for both men and women are presented in Table 4.

The analysis of wage changes between 2006 and 2016 indicated that individuals who persisted in a STEM occupation did not experience significantly greater earnings growth than their counterparts who had moved to a non-STEM occupation by 2016. This was true for both men and women, indicating that the wage growth of STEM graduates who exited a STEM occupation was similar to that of STEM graduates who remained in a STEM occupation.

The results also showed interesting relationships between STEM graduates' sociodemographic characteristics and wage growth. For example, older men and women experienced lower earnings growth than their younger counterparts. However, visible minority status, Aboriginal identity and immigrant status were not statistically significant. This may be because the sample was limited to individuals who were working in similar occupations (STEM occupations) in 2006.

Moreover, the wage growth of single men was higher than that of married men, while women who were divorced, separated or widowed had lower earnings growth than their married counterparts. Furthermore, while the presence of young children was not significantly associated with the wage growth of men, women who had children younger than 6 in 2006 experienced higher wage growth than their counterparts who did not have young children. Again, this finding may be attributable to the particular sample examined, as only women who were employed in a STEM occupation in 2006 were included in this part of the analysis.

The field of study results also indicated that, among men, mathematics and computer and information science graduates experienced lower wage growth than their engineering and engineering technology counterparts. Similarly, the wage growth of women who studied physical or chemical sciences was lower than that of women who studied engineering or engineering technology.

Lastly, since senior management occupations was one of the top occupational groups to which male STEM "leavers" moved (see Chart 10), additional models were run which excluded individuals who had moved to these occupations by 2016³⁹ because they likely earn much higher wages than individuals who moved into other types of non-STEM occupations. The results from these models supported the conclusion that the wage growth of men and women who persisted

36. Defined as gross wages and salaries before deductions such as income taxes. The reference periods for wages and salaries are the 2005 and 2015 calendar years.

37. Full-year, full-time employment is defined as having worked 49 to 52 weeks in the reference year for 30 hours per week or more.

38. This variable was used to obtain a general measure of provincial and territorial differences using a measure that does not change over time.

39. Results from these models are available upon request.

in a STEM occupation did not differ significantly from their counterparts who moved to a non-STEM occupation.

Table 4
Ordinary least squares regressions of difference between 2006 and 2016 log wages on sociodemographic, educational, and employment characteristics, STEM graduates who worked in a STEM occupation in 2006 and were employed full-year, full-time in both 2006 and 2016

	Men		Women	
	coefficient	standard error	coefficient	standard error
Age group (2006) (reference group: 25 to 34)				
35 to 44	-0.202 ***	0.020	-0.103 **	0.036
45 to 54	-0.326 ***	0.024	-0.192 ***	0.044
Marital status (2006) (reference group: married or common law)				
Single or never married	0.071 **	0.022	-0.006	0.038
Separated, divorced or widowed	-0.033	0.057	-0.086 †	0.049
Presence of young children in 2006 (reference group: did not have children younger than 6)	-0.005	0.019	0.171 ***	0.048
Visible minority status (reference group: not a visible minority)	-0.014	0.024	-0.026	0.063
Aboriginal identity (reference group: does not identify as member of Aboriginal group)	0.062	0.057	0.085	0.069
Immigrant status (reference group: Canadian-born)	-0.016	0.078	-0.174	0.176
Highest certificate, diploma or degree (reference group: bachelor's degree)				
College, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree	-0.031	0.019	0.000	0.031
University degree above a bachelor's degree	0.050 †	0.026	0.033	0.049
Location of study (reference group: outside Canada)	-0.011	0.029	-0.087	0.067
STEM field of study (reference group: engineering and engineering technology)				
Physical and chemical sciences	-0.027	0.048	-0.130 *	0.051
Biological, general and integrated sciences	-0.038	0.042	-0.015	0.055
Mathematics and computer and information sciences	-0.047 **	0.017	-0.047	0.032
Area of birth (reference group: Ontario)				
Newfoundland and Labrador	0.077 †	0.042	0.099	0.096
Prince Edward Island	0.230	0.145	0.247 †	0.144
Nova Scotia	-0.031	0.081	0.076	0.099
New Brunswick	0.036	0.032	0.028	0.053
Quebec	0.002	0.022	0.035	0.032
Manitoba	0.060	0.041	0.072	0.115
Saskatchewan	0.051	0.064	0.076	0.111
Alberta	0.138 **	0.044	0.072	0.051
British Columbia	0.015	0.048	0.132 *	0.060
Territories	0.171	0.118	0.020	0.108
Born outside Canada	0.054	0.077	0.255	0.164
Persisted in a STEM occupation	-0.012	0.022	0.050	0.037

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

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

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

† significantly different from reference category ($p < 0.10$)

Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; held a STEM occupation in 2006; were employed full year, full time, in 2006 and 2016; and had positive earnings in 2006 and 2016. The sample size was 8,636 for men and 1,844 for women.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

5 Conclusion

Although many studies have examined women's persistence in STEM fields throughout their education, less is known about the occupational pathways of women with STEM credentials and how they compare with their male peers. This study addressed this gap by conducting a gender analysis of the occupational mobility of STEM graduates in Canada and providing detailed results by different STEM fields of study.

Similar to previous research (e.g., Statistics Canada 2017a), the results indicated that men were more likely than women to be employed in a STEM occupation. Furthermore, the occupational pathways of women and men with STEM credentials differed. For example, more than 3 in 10 men were employed in a STEM occupation in both 2006 and 2016, compared with 2 in 10 women. The majority of women were not employed in a STEM occupation in either year.

Differences in the occupational pathways of men and women with STEM credentials were attributable in part to their specific field of study choices. In this study, over half of male STEM graduates had studied engineering or engineering technology, compared with less than one-quarter of female STEM graduates. Conversely, over one-third of female STEM graduates had studied biological, general or integrated sciences, compared with 12.5% of men. However, previous research indicates that engineering graduates were generally more likely than life science graduates to work in STEM occupations (Statistics Canada 2017a). Furthermore, Frenette and Frank (2017) found that physical and life science graduates tended to be employed across a wider range of occupations than engineering graduates, and many of these occupations were in non-STEM fields.

Among STEM graduates who were employed in a STEM occupation in 2006, women were more likely than men to have moved to a non-STEM occupation by 2016. Previous literature indicates that this difference may be due to differing career goals or interests. For example, Fouad et al. (2017) found that women had a greater tendency to leave engineering occupations and attributed this decision to factors such as an interest in applying their skills in another field, a desire to find work that makes a greater contribution to the community, or unmet expectations related to promotions or status within their field. Previous longitudinal research also found that much of the attrition of women in STEM occupations in the United States occurred during their first few years on the job (Glass et al. 2013). While data on job tenure were not available for this study, further research into this finding in the Canadian context would lead to a better understanding of women's retention in STEM occupations.

This study also found that STEM graduates who had studied physical or chemical sciences or biological, general or integrated sciences were more likely to exit STEM occupations than their engineering or engineering technology counterparts. This was true for both women and men. However, some field of study differences were observed. Men who studied mathematics or computer and information sciences were less likely than their counterparts who studied engineering or engineering technology to exit a STEM occupation between 2006 and 2016, while there was no statistically significant difference among women who studied in these two fields. The degree of occupational mobility among graduates of particular STEM fields could depend on the extent to which these graduates can apply their skills to a range of jobs, their professional networks or their preference for different types of work.

Family obligations are often identified as an important factor in women's labour market decisions. Research from the United States found that mothers and fathers of young children were more likely than their childless peers to exit STEM occupations (Cech and Blair-Loy 2019). However, results from this study showed that the presence of young children was not associated with the likelihood of exiting a STEM occupation for either women or men. Data limitations may be the reason for these differing results. Cech and Blair-Loy (2019) used data on parental leave, as well as knowledge of exactly when STEM workers' children were born. In addition to this lack of detail

in the longitudinal census data files, the longer period of study may have also contributed to different findings. Furthermore, the divergent results could stem from differences in the parental leave policies of Canada and the United States.

Previous research has also found that graduates who work in occupations closely related to their fields of study have higher earnings than those who do not (Xu 2013). This study measured wage growth, providing an indication of how STEM graduates' wages changed between 2006 and 2016, depending on whether they remained in a STEM occupation or moved to a non-STEM occupation. The findings indicated that the wage growth of women and men who persisted in a STEM occupation between these years did not differ significantly from that of their counterparts who had moved to non-STEM occupations. Therefore, while STEM occupations may be higher paying than non-STEM occupations on average (Xu 2015), STEM graduates who exited a STEM occupation did not experience lower wage growth than their peers who persisted in a STEM occupation.

The results of this study help fill the information gap on the occupational mobility of STEM graduates in Canada. However, data limitations hindered a more thorough investigation of some questions of interest. For example, restricting the sample to only those who responded to the 2006 and 2016 census long-form questionnaires prevented additional occupational information from being analyzed. While the inclusion of 2011 National Household Survey data could provide a more detailed picture of the occupational mobility of STEM graduates over time, it would also substantially decrease the sample size, potentially preventing specific groups from being analyzed (e.g., women in particular STEM fields). Additionally, data on parental leave would provide a more nuanced understanding of the relationship between parenthood—particularly among new parents—and the occupational changes of STEM graduates. Lastly, because of a lack of historical information on job vacancies in STEM occupations, it is difficult to ascertain how labour market opportunities may have affected the employment of STEM graduates in these occupations over the years studied. Future research would benefit from addressing these data and knowledge gaps.

The results of this study can help inform educators and policy makers about how the occupational pathways of different groups of STEM graduates vary, which would provide a better understanding of where policy interventions may be needed.

Appendices

Appendix Table 1

List of STEM occupations, National Occupational Classification for Statistics (NOC-S) 2006 and National Occupational Classification (NOC) 2016

NOC-S 2006		NOC 2016	
Code	Occupational title	Code	Occupational title
A121	Engineering managers	0211	Engineering managers
A122	Computer and information systems managers	0212	Architecture and science managers
A123	Architecture and science managers	0213	Computer and information systems managers
C011	Physicists and astronomers	2111	Physicists and astronomers
C012	Chemists	2112	Chemists
C013	Geologists, geochemists and geophysicists	2113	Geoscientists and oceanographers
C014	Meteorologists	2114	Meteorologists and climatologists
C015	Other professional occupations in physical sciences	2115	Other professional occupations in physical sciences
C021	Biologists and related scientists	2121	Biologists and related scientists
C022	Forestry professionals	2122	Forestry professionals
C023	Agricultural representatives, consultants and specialists	2123	Agricultural representatives, consultants and specialists
C031	Civil engineers	2131	Civil engineers
C032	Mechanical engineers	2132	Mechanical engineers
C033	Electrical and electronics engineers	2133	Electrical and electronics engineers
C034	Chemical engineers	2134	Chemical engineers
C041	Industrial and manufacturing engineers	2141	Industrial and manufacturing engineers
C042	Metallurgical and materials engineers	2142	Metallurgical and materials engineers
C043	Mining engineers	2143	Mining engineers
C044	Geological engineers	2144	Geological engineers
C045	Petroleum engineers	2145	Petroleum engineers
C046	Aerospace engineers	2146	Aerospace engineers
C047	Computer engineers (except software engineers and designers)	2147	Computer engineers (except software engineers and designers)
C048	Other professional engineers, n.e.c.	2148	Other professional engineers, n.e.c.
C051	Architects	2151	Architects
C052	Landscape architects	2152	Landscape architects
C053	Urban and land use planners	2153	Urban and land use planners
C054	Land surveyors	2154	Land surveyors
C061	Mathematicians, statisticians and actuaries	2161	Mathematicians, statisticians and actuaries
C071	Information systems analysts and consultants	2171	Information systems analysts and consultants
C072	Database analysts and data administrators	2172	Database analysts and data administrators
C073	Software engineers and designers	2173	Software engineers and designers
C074	Computer programmers and interactive media developers	2174	Computer programmers and interactive media developers
C075	Web designers and developers	2175	Web designers and developers
C111	Chemical technologists and technicians	2211	Chemical technologists and technicians
C112	Geological and mineral technologists and technicians	2212	Geological and mineral technologists and technicians
C113	Meteorological technicians	N/A	Not applicable
C121	Biological technologists and technicians	2221	Biological technologists and technicians
C122	Agricultural and fish products inspectors	2222	Agricultural and fish products inspectors
C123	Forestry technologists and technicians	2223	Forestry technologists and technicians
C124	Conservation and fishery officers	2224	Conservation and fishery officers
C125	Landscape and horticultural technicians and specialists	2225	Landscape and horticulture technicians and specialists
C131	Civil engineering technologists and technicians	2231	Civil engineering technologists and technicians
C132	Mechanical engineering technologists and technicians	2232	Mechanical engineering technologists and technicians
C133	Industrial engineering and manufacturing technologists and technicians	2233	Industrial engineering and manufacturing technologists and technicians
C141	Electrical and electronics engineering technologists and technicians	2241	Electrical and electronics engineering technologists and technicians
C142	Electronic service technicians (household and business equipment)	2242	Electronic service technicians (household and business equipment)
C143	Industrial instrument technicians and mechanics	2243	Industrial instrument technicians and mechanics
C144	Aircraft instrument, electrical and avionics mechanics, technicians and inspectors	2244	Aircraft instrument, electrical and avionics mechanics, technicians and inspectors

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

Source: Statistics Canada, Picot and Hou (forthcoming 2019).

Appendix Table 1**List of STEM occupations, National Occupational Classification for Statistics (NOC-S) 2006 and National Occupational Classification (NOC) 2016 (continued)**

NOC-S 2006		NOC 2016	
Code	Occupational title	Code	Occupational title
C151	Architectural technologists and technicians	2251	Architectural technologists and technicians
C152	Industrial designers	2252	Industrial designers
C153	Drafting technologists and technicians	2253	Drafting technologists and technicians
C154	Land survey technologists and technicians	2254	Land survey technologists and technicians
C155	Mapping and related technologists and technicians	2255	Technical occupations in geomatics and meteorology
C161	Non-destructive testers and inspectors	2261	Non-destructive testers and inspection technicians
C162	Engineering inspectors and regulatory officers	2262	Engineering inspectors and regulatory officers
C171	Air pilots, flight engineers and flying instructors	2271	Air pilots, flight engineers and flying instructors
C172	Air traffic control and related occupations	2272	Air traffic controllers and related occupations
C181	Computer network technicians	2281	Computer network technicians
C182	User support technicians	2282	User support technicians
C183	Systems testing technicians	2283	Information systems testing technicians

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

Source: Statistics Canada, Picot and Hou (forthcoming 2019).

Appendix Table 2

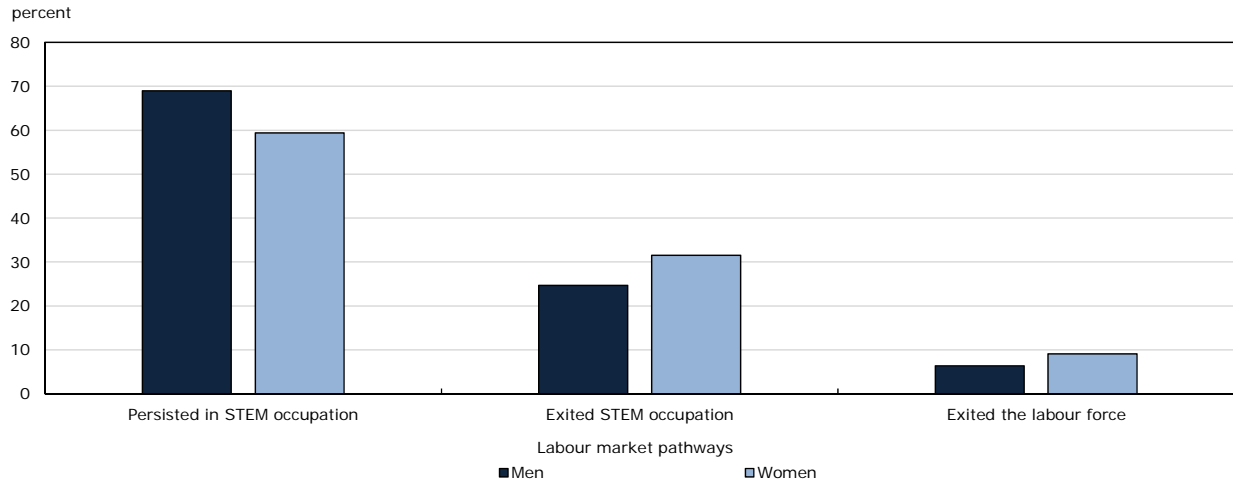
Top non-STEM occupational groups to which STEM graduates who exited a STEM occupation moved, by field of study (occupations held in 2016)

Non-STEM occupational groups	Share percent
Men	
Physical and chemical sciences	
Professional occupations in law and social, community and government services	12.0
Middle management occupations in trades, transportation, production and utilities	8.8
Senior management occupations	7.6
Professional occupations in education services	6.8
Processing, manufacturing and utilities supervisors and central control operators	6.4
Biological, general and integrated sciences	
Professional occupations in law and social, community and government services	14.2
Specialized middle management occupations	11.1
Senior management occupations	8.3
Middle management occupations in trades, transportation, production and utilities	6.2
Professional occupations in business and finance	5.7
Engineering and engineering technology	
Middle management occupations in trades, transportation, production and utilities	15.0
Specialized middle management occupations	8.1
Senior management occupations	7.2
Industrial, electrical and construction trades	7.0
Maintenance and equipment operation trades	5.6
Mathematics and computer and information sciences	
Specialized middle management occupations	15.8
Professional occupations in business and finance	12.1
Senior management occupations	8.1
Administrative and financial supervisors and administrative occupations	6.2
Middle management occupations in retail and wholesale trade and customer services	5.3
Women	
Physical and chemical sciences	
Specialized middle management occupations	10.9
Professional occupations in education services	10.1
Office support occupations	7.8
Professional occupations in law and social, community and government services	7.8
Care providers and educational, legal and public protection support occupations	6.2
Biological, general and integrated sciences	
Professional occupations in law and social, community and government services	18.1
Professional occupations in education services	9.7
Technical occupations in health	8.6
Specialized middle management occupations	7.0
Professional occupations in business and finance	7.0
Engineering and engineering technology	
Middle management occupations in trades, transportation, production and utilities	11.5
Specialized middle management occupations	10.6
Professional occupations in business and finance	9.8
Administrative and financial supervisors and administrative occupations	8.9
Office support occupations	6.1
Mathematics and related studies, computer and information sciences	
Professional occupations in business and finance	16.9
Administrative and financial supervisors and administrative occupations	15.1
Specialized middle management occupations	13.6
Office support occupations	6.5
Professional occupations in law and social, community and government services	6.5

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

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

Appendix Chart A.1
Labour market pathways of STEM graduates who held a STEM occupation in 2006, by sex



Notes: STEM stands for science, technology, engineering and mathematics. The sample consisted of Canadian-born and immigrant individuals aged 25 to 54 in 2006 who completed a college, CEGEP or other non-university certificate or diploma or university certificate below a bachelor's degree, or a university degree in a STEM field of study; reported the same level of education in 2006 and 2016; and were employed in a STEM occupation in 2006.

Sources: Statistics Canada, 2006 and 2016 longitudinal census files.

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