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 **EPRI** Education Policy
Research Initiative
Initiative de recherche sur les politiques de l'éducation

Research Report



How Much Do They Make?

New Evidence on the Early Career Earnings of Canadian Post-
Secondary Education Graduates by Credential & Field of Study

The Authors

This report results from a collaboration between the Education Policy Research Initiative (EPRI) and the Labour Market Information Council (LMIC). The conceptual design of the analytical framework, sample construction, data extraction, and empirical analysis were carried out by EPRI. The report was authored by EPRI, with substantial drafting contributions and input from LMIC.

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Table of Contents

Acknowledgments	ii
List of Tables, Figures & Boxes	iv
Executive Summary	viii
About this Report & Project	xiii
1.0	1
Introduction	
2.0	3
Related Literature	
3.0	11
Data & Analytical Approach	
4.0	26
Earnings of Post Secondary Graduates	
5.0	65
Discussion of the Findings	
6.0	68
Conclusion	
7.0	69
References	

List of Figures, Tables & Boxes

FIGURES

Figure 1	23
Sample Restrictions by Years Since Graduation, 2010 Cohort	
Figure 2	27
Average Earnings of PSE Graduates by Credential	
Figure 3	28
First and Fifth Year Average Earnings and Percentage Growth of PSE Graduates by Credential	
Figure 4	29
Select Earnings Percentiles (10th, 25th, 50th, 75th and 90th) for PSE Graduates by Credential	
Figure 5	32
Average Earnings of College-Level Certificates by Field of Study	
Figure 6	33
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for College-Level Certificate Graduates by Field of Study	
Figure 7	34
Average Earnings of College-Level Diploma Graduates by Field of Study	
Figure 8	36
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for College-Level Diploma Graduates by Field of Study	
Figure 9	37
Average Earnings of Bachelor's Degree Graduates by Field of Study	
Figure 10	38
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Bachelor's Degree Graduates by Field of Study	
Figure 11	39
Average Earnings of Master's Degree Graduates by Field of Study	
Figure 12	40
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Master's Degree Graduates by Field of Study	

Figure 13	41
Average Earnings of Doctoral Degree Graduates by Field of Study	
Figure 14	43
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Doctoral Degree Graduates by Field of Study	
Figure 15	43
Average Earnings of Professional Degree Graduates by Field of Study	
Figure 16	44
Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Professional Degree Graduates by Field of Study	
Figure 17	46
Average Earnings by Credential within Each Field of Study	
Figure 18	47
Average Earnings of Female and Male Graduates by Credential	
Figure 19	50
Gender Earnings Differentials of College-Level Certificate Graduates by Field of Study, One and Five Years after Graduation	
Figure 20	52
Gender Earnings Differentials of College-Level Diploma Graduates by Field of Study, One and Five Years after Graduation	
Figure 21	52
Gender Earnings Differentials of Bachelor's Degree Graduate by Field of Study, One and Five Years after Graduation	
Figure 22	53
Gender Earnings Differentials of Master's Degree Graduates by Field of Study, One and Five Years after Graduation	
Figure 23	54
Gender Earnings Differentials of Doctoral Degree Graduates by Field of Study, One and Five Years after Graduation	
Figure 24	55
Gender Earnings Differentials of Professional Degree Graduates by Field of Study, One and Five Years after Graduation	
Figure 25	58
Distributions (%) of PSE Credentials by International Student Status, Before Sample Restrictions and One Year After Sample Restrictions	

Figure 26	59
Average Earnings of International and Canadian PSE Graduates by Credential	
Figure 27	61
International Student Earnings Differentials of College-level Diploma Graduates by Field of Study, One and Five Years after Graduation	
Figure 28	62
International Student Earnings Differentials of Bachelor's Degree Graduates by Field of Study, One and Five Years after Graduation	
Figure 29	63
International Student Earnings Differentials of Master's Degree Graduates by Field of Study, One and Five Years after Graduation	
Figure 30	64
International Student Earnings Differentials of Doctoral Degree Graduates by Field of Study, One and Five Years after Graduation	

TABLES

Table 1	18
Graduation Date and Tax Year Structure	
Table 2	21
The Number and Distribution of Graduates by Credential and Cohort	
Table 3	22
The Number and Distribution of Graduates by Credential across Provinces, All Cohorts	
Table 4	24
Final Sample, 2010 Cohort Table	
Table 5	25
Summary Statistics, 2010 Cohort, Final Sample (One Year after Graduation)	
Table 6	31
Fields of Study with Sufficient Sample Sizes by Credential	
Table 7	48
Share of Female Graduates (%) by Credential and Field of Study, One Year after Graduation	
Table 8	56
Distribution (%) of Canadian and International Student Graduates by Credential, Before and After Sample Restrictions	

Table 9 **60**
Share of International Student Graduates (%) by Credential and Field of Study, One Year
After Graduation

BOXES

Box 1 **17**
STEM & non-STEM Fields of Study

Box 2 **49**
Limitations & Caveats for Gender Earning Differentials

Executive Summary

The decision to further one's education and training has important individual and societal implications.

Choices about post-secondary education (PSE) launch individuals onto their future educational and career paths. These decisions are vitally important to Canada's economic prosperity as well to many individual and social outcomes. Against this backdrop, this joint LMIC-EPRI report provides extensive new evidence on the labour market earnings of PSE graduates.

Our analysis makes extensive use of the new Education and Labour Market Longitudinal Platform (ELMLP), developed by Statistics Canada and Employment and Social Development Canada. The ELMLP allows us to identify all college and university graduates from publicly funded Canadian PSE institutions from 2010 through 2014. We then track their annual employment earnings from the first year following graduation through 2015. This report focuses on individuals who graduated in 2010, since they have the longest earnings history observed on the current platform (2011–2015).

Our analysis of earnings is presented first by credential and then by field of study within each credential, thus providing broader and more detailed perspectives. The six credentials included are as follows: 1) college-level certificates, 2) college-level diplomas, 3) bachelor's degrees, 4) master's degrees, 5) doctoral degrees and

6) professional degrees. Eleven primary fields of study are included, covering a full range of domains: Education, Visual and performing arts, and communications technologies, Humanities, Social and behavioural sciences and law, Business, management and public administration, Physical and life sciences and technologies, Mathematics, computer and information sciences, Architecture, engineering and related technologies, Agriculture, natural resources and conservation, Health and related fields and Personal, protective and transportation services.

Our aim is to provide all PSE stakeholders — students, parents, institutions, policy makers, researchers and the broader Canadian public — with new earnings information that will help them make the most informed decisions possible. To that end, the report also is complemented by an [interactive dashboard](#), allowing readers to explore the data further, according to their own interests and needs.

While salary is only one factor that Canadians consider when deciding to pursue PSE, our research indicates that it is the most sought after one by students. Other potentially important labour market outcomes are not yet available in the current ELMLP data environment, including benefits, contract status and hours worked.

For a decision of such magnitude, earnings should be used in combination with other information, along with guidance from family and others. One's personal interests

and abilities, of course, should also be taken into account.

Earnings vary by credential, but for all 2010 PSE graduates, real earnings grew from \$43,100 to \$59,300, an increase of 8.4% per year (38% in total) from 2011 to 2015.

We find that the earnings of college-level graduates with certificates and diplomas follow very similar trends after graduation, starting at approximately \$35,000 and reaching \$47,000 five years later (all earnings are expressed in constant 2016 dollars). For bachelor's degree graduates, earnings start at \$41,100 in the first year and increase to \$58,700 five years later. For master's and doctoral degree graduates, average earnings start at \$65,200 and \$60,100, respectively. Both then reach approximately \$83,000 in the fifth year following graduation. Professional degree graduates — doctors, lawyers, dentists and pharmacists — start at \$68,300 and rise to approximately \$99,600.

Seen from another perspective, college-level diploma and certificate graduates have average cumulative earnings growth of 35% and 31% over the five-year period, after adjusting for inflation. This represents 7.8% and 7.0% average growth per year, respectively. Earnings increase 43% in total (9.3% per year) for bachelor's graduates; 27% (6.2% per year) for master's degree graduates; 38% (8.3% per year) for doctoral degree holders; and 46% (9.9% per year) for professional degree graduates.

Considering all PSE students taken together, 2010 graduates saw an increase

in earnings from \$43,100 to \$59,300 (38%) by 2015, an average of 8.4% per year. In context — not to be compared directly — during the same 2011–2015 period, all Canadians with and without PSE in the same general age group (22–28 years in 2010) saw average real earnings growth of 24% or 5.6% per year.

Five years after graduation, earnings vary widely by field of study within credentials, with the top fields earning between 40% and 60% more than graduates from fields with the lowest earnings.

On average, graduates in **Architecture, engineering and related technologies** earn the most among college-level certificate, college-level diploma and bachelor's degree students five years after graduation (respectively, \$60,500, \$64,500 and \$80,400). Among master's and doctoral graduates, those from **Business, management and public administration** earn the most (\$103,800 and \$123,600, respectively).

At the other end of the spectrum, graduates in the **Humanities** with college-level certificates and diplomas and doctoral degrees, and graduates in **Visual and performing arts, and communication technologies** with bachelor's and master's degrees earn the least. These graduates earn between 43% less (\$27,500) for college-level diplomas and 61% less (\$62,800) for master's degrees than those from the highest earning fields of study.

The exception to these large differences is among professional degree graduates, for

whom only two fields of study are observed: **Social and behavioural sciences, and law** and **Health and related fields**. Graduates from these two fields (primarily doctors and lawyers) earn essentially the same amount five years after graduation.

In every field of study, women earn less than their male counterparts five years after graduating and in the vast majority of cases average gender earnings differences increase from year one to year five.

Across the six credentials, women earn 2% to 21% less than men in their first year following graduation. This difference grows to between 16% (doctoral degree) and 34% (college-level certificate) after five years.

Averaging across all credentials, women earn 12% (\$5,700) less than men one year after graduation. This difference widens every subsequent year, in both absolute and relative terms, to 25% (\$17,700) five years after graduation.

Gender earnings differences vary by field of study — in some instances substantially — and increase over time in the vast majority of cases. Of our 51 credential and field of study categories, women earn more than men in only three cases in the first year after graduating. By the fifth year, women earn less than men in every case.

For instance, five years after graduating, female college-level certificate and diploma holders in **Education** earn about 45% (\$28,500) less than their male counterparts. For master's degree holders in **Visual and performing arts, and communication technologies**, and **Business, management**

and public administration, women earn 32% less than men (\$16,800 and \$39,600, respectively). In some fields, however, the differentials are considerably smaller. For bachelor's degree graduates in **Health and related fields**, women earn 1.9% (\$1,300) less than men.

International students who stay and work in Canada earn less than their Canadian counterparts, but the differences narrow over time.

Across four of the five credentials observed, international students earn between 17% and 38% less than Canadians one year after graduation. However, these differences narrow to between 5% (doctoral degree) and 20% (master's degree) five years out. Among college-level certificate graduates, international students have similar earnings to Canadian graduates.

Taking graduates at all credential levels together, international students who graduated in 2010 and then stayed and worked in Canada earned 21% (\$9,000) less than Canadian graduates one year following graduation.

By field of study, only international students with master's degrees in **Mathematics, computer and information sciences**, and **Health and related fields** earn more than their Canadian counterparts — an additional 7.8% (\$5,800) and 6.0% (\$4,600) five years after graduating. Two of the largest differences observed are also among master's degree holders. Master's graduates in **Business, management and public administration**, as well as **Education**, earn 35.5% (\$37,800) and 40.0% (\$32,400) less than Canadian graduates.

In contrast to the patterns observed by gender, the earnings differences between Canadian and international student graduates tend to narrow over time in relative terms.

Graduates are doing well, on average, but the spread between higher and lower earners is wide and grows over time within each credential.

Credentials with higher average earnings (i.e., professional, doctoral and master's degrees) are associated with wider distributions of earnings across graduates. The spread between the lowest (10th percentile) and highest (90th percentile) earners is \$80,200 for professional degrees, \$90,800 for master's degrees and \$94,900 for doctoral degrees in the first year after graduation. In all cases, the absolute gap between the highest and lowest earners increases over time. The difference reaches \$126,700 for professional degree holders five years after graduation, and \$106,800 and \$110,100 for master's and doctoral degrees.

The spread among college-level certificate and bachelor's degree graduates rises from approximately \$58,100 to \$76,100 from the first to the fifth year following graduation. The earnings differential between the highest and lowest college-level diploma holders starts at \$46,300 in year one and rises to \$65,900, representing the smallest spread among all credentials.

The distributions of earnings across credentials overlap, meaning that — in some cases — graduates with higher average earnings (e.g., doctoral degrees)

sometimes earn less than those with credentials with lower average earnings (e.g., bachelor's degrees). We find similar results at the field of study level: the distributions of earnings again vary quite widely and they overlap.

Forthcoming research will build upon this report to provide additional information to support the decision-making of Canadians.

This report provides new and comprehensive evidence on the early career earnings of Canadian PSE graduates. A forthcoming EPRI-LMIC report will provide a comparable analysis of the earnings of those who complete registered apprenticeship programs. Taken together, these reports and related materials, including the [interactive dashboard](#), will provide expansive new information on the earnings of PSE graduates and apprenticeship completers. This information will help Canadians make the most informed education and training decisions possible.

The ELMLP has a variety of limitations that affect the type of information that can be presented. However, Statistics Canada is working on adding more data to the ELMLP that will allow for a more detailed and extended analysis. This will include the introduction of new data sources, such as the 2016 Census and the Immigration Longitudinal Database (IMDB). Furthermore, as additional years of data are added, the ELMLP will include new cohorts of graduates, allowing them to be followed for increasingly longer intervals, thereby remaining a valuable source of labour market information.

About this Report & Project

Data and Analysis

This project uses the newly available Education and Labour Market Longitudinal Platform (ELMLP), which allows anonymous data on PSE students provided by publicly funded Canadian post-secondary education institutions to be linked to Canada Revenue Agency tax records.

For our analysis, we focus on students who graduated in 2010 and then track their labour market earnings on an annual basis. Data on students who graduated in subsequent years are also made available.

Presentation of the Findings

The findings of the empirical analysis discussed in this report are presented in a series of graphs and tables, which can also be downloaded from the [Labour Market Information Council website](#). Links also allow the graphs to be opened directly on the [interactive dashboard](#).

Additional findings are presented in the report's appendix, with links provided where they are referred to.

Interactive Dashboard

To make our findings more accessible to readers, we have created a new [interactive dashboard](#). Users of the dashboard can

create, capture and download data filtered by credential, field of study, gender and more.

The dashboard holds much more data than the research report. Users are encouraged to explore across the different dimensions available.

More to Come

Sign up for the Labour Market Information Council's [newsletter](#) for updates. Ongoing [LMI Insight Reports](#) and [blogs](#) provide readers with an in-depth dive into gender earning differentials, international students and more.

Want to Share?

We have developed various tools to explain the report findings. They are designed to share easily across social networks. You will find these and many more on our [Twitter](#) and [LinkedIn](#) pages:

- [Video](#)
- [Infographic](#)

1.0 Introduction

The investments that Canadians make in post-secondary education (PSE) play a pivotal role in determining their labour market opportunities and career pathways. Collectively, these decisions are also of vital importance to the country's economic prosperity and are associated with a wide range of other individual and social outcomes. It is therefore essential to have reliable, up-to-date, readily available information on post-secondary education graduates' labour market outcomes so that all stakeholders in the PSE system — students, parents, institutions, policy makers, researchers, and the broader Canadian public — can make more informed decisions.

In this context, the [Education Policy Research Initiative \(EPRI\)](#)¹ and the [Labour Market Information Council \(LMIC\)](#)² have partnered to provide extensive new evidence on the labour market earnings of recent graduates from Canadian public post-secondary institutions. This information is based on an analysis undertaken by EPRI, supplemented with insights from LMIC, using the remarkably rich [Education](#)

and [Labour Market Longitudinal Platform \(ELMLP\)](#) recently developed by Statistics Canada and Employment and Social Development Canada (ESDC). The ELMLP includes information on students taken from anonymized administrative records provided by all publicly funded colleges, institutes, and universities in Canada and then linked to personal income tax information from the Canada Revenue Agency (CRA). In this way, the platform allows individuals to be linked across their entire set of post-secondary education and tax records through time.³

In this project, we extend the approach established in two earlier projects using PSE-tax linked administrative data for limited sets of PSE graduates (Finnie et al. 2014; 2016; 2018).⁴ With the ELMLP, we are now able to identify all students who graduated from a Canadian PSE institution from the calendar year 2010 through 2014 and track their earnings on a year-by-year basis from the first year following graduation, that is 2011, through 2015.

¹ EPRI is an academic research group based at the University of Ottawa that engages in research aimed at informing policy discussions focused on education, skills, and the labour market.

² LMIC is an independent not-for-profit organization whose mission is to provide Canadians with timely and reliable labour market information and insights in an engaging way to support their decision-making process.

³ For more details about the data available on the ELMLP, see LMIC (2018b) or Statistics Canada (2018c).

⁴ As discussed further below, these two pilot projects related to the development of the ELMLP were undertaken in partnership with Statistics Canada.

This report identifies the earnings trajectories of graduates by credential and field of study. The credentials include: college-level certificates and diplomas, and bachelor's, master's, doctoral, and professional degrees (Statistics Canada, 2018c). The fields of study consist of 11 primary groupings based on the Classification of Instructional Programs (CIP). Earnings are tracked separately for each cohort of graduates from 2010 through 2014 with emphasis placed on the earliest cohort (2010 graduates) as they can be followed for the longest period after graduation (five years).

The report is structured as follows: [Section 2.0](#) presents a review of the literature related to the earnings of college and university graduates. [Section 3.0](#) describes the ELMLP data and highlights the analytical limits of the data. [Section 4.0](#) presents the findings, first at the overall credential level and then by field of study, followed by breakdowns of earnings by gender and for international students. [Section 5.0](#) summarizes these results and places them in the context of the existing literature. Finally, [Section 6.0](#) concludes and looks toward the next phases of this joint research project.

2.0

Related Literature

Since the early 1980s, the share of Canadians with a post-secondary education (PSE) credential has been increasing. In 1981, 35.7% of the female working-age population (15–64) and 42.5% of the male working-age population held a post-secondary credential (Statistics Canada, 1982). These numbers increased to 55.9% for women and 54.5% for men by 2016 (Statistics Canada, 2016). This significant increase in the share of PSE graduates and their associated labour market outcomes has been the subject of extensive theoretical and empirical research. Much of this literature has focused on the earnings of graduates.

Historically, information on PSE graduates' earnings in Canada has been provided through national and institutional surveys as well as census data. Most studies have focused on how certain sets of graduates have done compared to others within Canada and how Canadian graduates have fared in the labour market in comparison to graduates around the world. Over years of research, Canadian graduates' earnings have been compared by credential, field of study, graduating cohort, academic performance, type of institution, and a wide array of individual characteristics (gender, age, parents' education, economic status, etc.). While some studies take an explicit rate-of-return approach (e.g., Moussaly-Sergieh

& Vaillancourt, 2009), most opt for a simpler focus on earnings differences between those with and without PSE credentials, known as earnings premia. This strategy simplifies the analysis, as it only requires investigating earnings. By contrast, measuring the rate-of-return of PSE requires the consideration of both its direct and opportunity costs, which considerably complicates the analysis.

In this short review of the literature, we focus primarily on Canadian research. We first review studies based on national surveys as well as census data. We then look at studies that use survey and census information linked to tax information. We conclude by focusing on studies that link administrative student-level data to tax records — as done in this project — in Canada and abroad.

2.1 Survey- & Census-Based Studies

Canadian researchers have used a number of national surveys to conduct research on the earnings of PSE graduates: the National Graduate Survey (NGS), the Survey of Labour Income Dynamics (SLID), the Labour Force Survey (LFS), the Survey of Consumer Finance (SCF), as well as the census.

National Graduate Survey (NGS)

Using the 1995 cohort of the NGS, Taillon and Paju (1999) show that graduates with education credentials that took longer to acquire had higher average earnings. For example, doctoral and master's graduates had median annual earnings of \$47,000, followed by bachelor's at \$32,000, college graduates at \$25,700, and trade/vocational graduates at \$23,400. Walters (2004) finds a similar association between average earnings and type of credential using four cohorts of the NGS (1982, 1986, 1990, and 1995). In terms of field of study, however, he finds the earnings of liberal arts graduates, relative to those of graduates of applied fields, did not change over the period examined.

Boothby (2000) uses the NGS to study earnings differences, which in some cases were substantial, by field of study. The differences he observes are statistically significant, and consistent across cohorts. The research of Finnie (2001) and Finnie and Frenette (2003) corroborates Boothby's findings, and further analyzes earnings by age and gender. Finnie and Frenette (2003) suggest that among bachelor's level university graduates in Canada, those in the fields of "other health," engineering and computer science, commerce, and mathematics/physics had the highest earnings; arts and humanities, agricultural/biological sciences, and "other social" had the lowest, and education and economics were in the middle of the earnings distribution. They also find that the patterns are relatively consistent for male and female graduates across three cohorts of graduates.

Using a similar approach and the same survey, but with publicly available information on Canadian institutions added, Betts, Ferrall, and Finnie (2013) observe that university characteristics (e.g., professor-student ratio, enrollment, and fees) can affect labour market outcomes. Boudarbat (2008) finds that anticipated earnings are an important factor in the selection of field of study at the community college level. The findings show that students who selected business and commerce or sciences were relatively more sensitive to earnings variations, while those who selected social sciences were the least sensitive to monetary motives. The author also shows that women put less weight on earnings compared to men when choosing a field of study.

Focusing on the difference in earnings between female and male graduates, Finnie and Wannell (2004) find that the difference in the first years after graduation narrowed significantly across successive cohorts from 1984 to 1992, but the earnings difference still remained large five years after graduation. When controlling for other factors, however, most importantly hours worked, the earnings gap is fully explained two years after graduation and almost the entire gap is explained five years after graduation. In contrast, Boudarbat and Connolly (2013) look at the earnings gap and finds that female graduates earned on average 6-14% less than males from two to five years after graduation. Unlike Finnie and Wannell (2004), their decomposition exercise shows that observable personal characteristics and job attributes explained only a small portion of the earnings gap.

Other studies have looked at the labour market outcomes of Indigenous PSE graduates. Walters, White, and Maxim (2004) finds that graduates from visible minority groups earned more than Indigenous and non-minority graduates, but after controlling for sociodemographic characteristics, level of schooling and field of study, Indigenous graduates earned more than the other two groups. Frenette (2010) finds that the returns to completing a university degree were generally higher for Indigenous graduates both in absolute and relative terms, but the rates of return for completing a trade/vocational certificate or apprenticeship, a college certificate, or a university certificate below a bachelor's degree were generally lower for Indigenous people.

For graduates with disabilities, Zarifa, Walters, and Seward (2015) report that they earned significantly less than other graduates even after controlling for various characteristics. The earnings gaps between graduates with and without disabilities varied significantly across fields of study and levels of schooling. Graduates who reported having a disability and had degrees in liberal arts and business experienced the largest earnings inequality relative to those in other fields of study.

Census

Lemieux (2014) uses data from both the NGS (cycle 2005) and the 2006 Census to show that PSE had a positive effect on the productivity level of individuals in a given job and increased their chances of getting a higher paying job. The study suggests that productivity effects accounted for approximately half of the wage

differences between university and high school educated individuals. He also shows that there is a close but not one-to-one correlation between occupations and fields of study.

Ferrer and Riddell (2002) use the 1996 Census to explore “sheepskin effects,” defined as any difference in labour market earnings associated with attaining a credential after controlling for educational inputs such as years of schooling. This study finds strong evidence of sheepskin effects associated with graduation from high school, community college or trade school, and university. They also report additional impacts for those who received more advanced credentials: master's degree holders earned 7–10% more than those with a bachelor's degree, and medical and related professional degree holders earned 30% more than those with a bachelor's degree. The study suggests that the magnitudes of diploma effects varied by field of study. Across all fields, bachelor's degrees with engineering had the largest, and humanities and social sciences had the smallest impacts.

Boudarbat, Lemieux, and Riddell (2010) use mean weekly earnings from the 1981 to 2006 Censuses to examine graduates' earnings by gender in Canada. They find that men with PSE credentials earned higher income by 8 percentage points compared to non-PSE workers, whereas women with PSE credentials earned 6 percentage points more when compared with non-PSE workers during this period.

Finally, Zhao, Ferguson, Dryburgh, Rodriguez, and Subedi (2017) also use the census to discover that

science, technology, engineering, and mathematics bachelor's graduates had higher earnings than those in business, humanities, health, arts, social science, and education.

Other National Surveys

Comparing the earnings of PSE graduates between the United States and Canada using the SCF, LFS, and SLID, Robb, Magee, and Burbidge (2003) and Burbidge, Magee, and Robb (2002) show that the PSE earnings premium (relative to high-school graduates) rose sharply from 1981 to 1999 in the US, while remaining constant or falling in Canada over this 19-year period. Giles and Drewes (2001) use the same surveys to determine that social sciences and humanities graduates had, on average, lower earnings than graduates of more vocationally oriented programs.

2.2 Studies Using Tax-Linked Data

Frenette (2019a) uses the census linked to tax data to compare the long-term labour market outcomes of two graduate cohorts: the 1991 cohort, age 26 to 35, were followed for up to 15 years (to 2005), and the similarly aged 2001 cohort, were followed up to 2015. He found that median cumulative earnings were higher for the more recent cohort of PSE graduates across all credentials and none of the fields of study experienced a decline in cumulative earnings.

Frank and Frenette (2019) merge

the National Apprenticeship Survey (NAS) and tax data to investigate women's participation in male-dominated trades. They find that women who are Canadian born, older, or who have a father with a trades certificate were more likely than other female apprentices to choose a male-dominated program. However, women in male-dominated apprenticeship programs generally had poorer labour market outcomes than their male counterparts.

Using a combination of the 2006 Census, the 2011 National Household Survey (NHS), and tax data, Frank, Frenette, and Morissette (2015) study how real annual wages and salaries of young Canadian-born PSE graduates evolved by field of study over the 2005 to 2012 period. The results show that young male graduates in engineering and young female graduates in health experienced moderate earnings growth over the period. Young male graduates with a bachelor's degree in mathematics, computer, and information science had no growth in median or average earnings, while their counterparts with a college certificate experienced earnings growth. Young female bachelor's degree holders in business administration and education and young male college graduates in Personal & Protective Services also experienced an increase in their median and average earnings.

Hou and Lu (2017) use a series of immigration databases,⁵ the census, the Longitudinal Worker File (LWF), and tax data to look at the earnings of three groups of graduates: immigrants

⁵ The Temporary Residents File (TRF), the Immigrant Landing File (ILF), and the Longitudinal Immigration Database (IMDB).

who are former international students in Canada (Canadian-educated immigrants), foreign-educated immigrants who had a university degree before immigrating to Canada, and the Canadian-born population. The results show that Canadian-educated immigrants on average had much lower earnings than the Canadian-born population but higher earnings than foreign-educated immigrants, both in the short term and long term.

2.3 Studies Using PSE Administrative Data Linked to Tax Data

Earlier research on the labour market outcomes of graduates from Canadian PSE institutions, as discussed above, is based on survey and census data, with a small number of studies linking survey and census data to tax data. No data sources were then available that linked PSE administrative and tax data to facilitate the analysis of PSE graduates' earnings, which is the approach adopted in this project.

There have, however, now been a small number of important studies in Canada using PSE-tax linked data. Heisz (2001) linked administrative records of British Columbia bachelor's graduates from 1974 to 1996 taken from the University Student Information System (USIS) — a precursor to the Postsecondary Student Information System (PSIS) — to 1982–1997 tax records (T1 Family File [T1FF]). He finds that the median real market income in the first years following graduation was lower for more recent graduates than for earlier cohorts. However, the growth rate of earnings was higher for more recent cohorts, which resulted in

their incomes exceeding past cohorts in the following years. In terms of field of study, the study finds that annual incomes after graduation are relatively high for graduates with applied degrees such as engineering, education, and health fields, however, income gaps across fields of study narrowed as graduates aged.

Using the same PSE-tax linked (USIS-T1FF) data, with the addition of the Longitudinal Employment Analysis Program (LEAP) database, Oreopoulos, von Wachter, and Heisz (2012) analyze the magnitude and sources of long-term earnings declines associated with graduating from university during a recession. They find that more advantaged graduates, based on predicted labour market success (related to institution type, program of study, and level of study), suffered less from graduating in a recession because they quickly switched to better firms; the earnings of less advantaged graduates, however, can be permanently affected by cyclical downturns.

The work by Finnie, Pavlic, Jevtovic, and Childs (2014) relies on a dataset that partially laid the groundwork for the development of the ELMLP. They linked PSE administrative data for University of Ottawa students who graduated with a bachelor's degree from 1998 to 2010 to tax data (T1FF), tracking graduates through 2011. Earnings in the first year after graduation for all graduates taken together varied between \$41,000 and \$47,000 over the entire 1998–2011 period, increasing substantially in the years following graduation. Across fields of study, graduates from business, engineering, and computer

sciences had a high earnings profile, and those in humanities and the social sciences tended to have an average earnings profile.

Finnie, Pavlic, and Childs (2018) use the same data on University of Ottawa graduates to focus on those with bachelor's degrees in information and communication technology (ICT). These graduates and non-ICT engineers generally had higher earnings than graduates from all other disciplines taken together. However, ICT graduates' earnings fell sharply after the dot-com bust, after which they partially recovered and then remained relatively stable.

Finnie, Afshar, Bozkurt, Miyairi, and Pavlic (2016) extend the analysis to include graduates from 14 colleges and universities from four Canadian provinces, again linking PSE administrative data on graduates, in this case from 2005 through 2012, to tax data through 2013. The 2005 bachelor's degree cohort of graduates had average annual earnings of \$45,200 in the first year after graduation, growing by 66% to reach \$74,900 eight years out. The same cohort of college-level diploma graduates had mean annual earnings of \$33,900 in the first year following graduation, growing by 59% to \$54,000 eight years after graduation.

This study also finds that engineering graduates had relatively high earnings. While it has been commonly assumed that fields of study such as humanities and social sciences experience low earnings levels and limited career progression, the evidence presented in this study suggests otherwise. Finnie et al. (2016) represents the point of

departure for the analysis presented in this report, which extends to all Canadian colleges and universities using Statistics Canada's new ELMLP, linking PSE administrative data to tax records.

Statistics Canada has also published two reports using the ELMLP. In the first report, Galarneau, Hinchley, and Ntwari (2017) use the linked PSIS with TIFF to examine the labour market outcomes of graduates from universities in the Maritime Provinces (Prince Edward Island, Nova Scotia, and New Brunswick). They present the earning trends of six cohorts who graduated from 2006 to 2011 with a bachelor's, master's, or doctoral degree across 11 primary fields of study. They show that the most common fields (in descending order) for women at the undergraduate level included health and related fields; social and behavioural sciences and law; business, management and public administration; and education, while the top fields for men were business, management and public administration; architecture, engineering and related technologies; social and behavioural sciences and law; and humanities.

One of the main findings of Galarneau et al. (2017) is that one year after graduation, graduates with a bachelor's degree from the 2009 cohort earned 8% less than their counterparts from the 2008 cohort. This can be explained by the 2008–2009 recession, which impacted the subsequent cohorts as well; those graduating in 2010 and 2011 with a bachelor's degree also had lower first-year earnings than those who graduated in 2008.

In the second report, Statistics Canada (2018b) uses the same datasets available in the ELMLP for all public Canadian universities and colleges from 2010 to 2015, including the six education credentials studied here: college-level certificate, college-level diploma, bachelor's, master's, doctoral, and professional degrees. Again, they find graduates with post-graduate credentials generally had higher median employment income for all cohorts. They also compare employment income across credentials two and five years after graduation for the 2010 and 2011 cohorts and found that professional degree holders had the highest median employment income, and graduates with a master's degree had slightly higher median employment income two years after graduation than those with a doctoral degree, although the doctoral degree graduates earned slightly more five years after graduation. This study also suggests that, at the undergraduate level, those in health and related fields, and architecture, engineering, and related technologies had the highest median earnings after five years since graduation, while those in visual and performing arts, and communications technology experienced the lowest earnings level.

In another recent study, Frenette (2019b) identifies the relationship between PSE and earnings five years after graduation across different levels of parental income. He links the PSIS with tax records through the ELMLP for Ontario post-secondary graduates (cohort 2010) and uses a comparison group of Ontarians who did not attend a PSE institution. The study suggests that youth coming from low-income families (at or below the

20th percentile) had a higher return associated with PSE than those from high-income families (at or above the 20th percentile). That is, the difference in earnings between PSE and non-PSE graduates coming from low-income families is greater than that for those coming from high-income families.

International PSE-Tax Linked Databases

In terms of administrative data implemented in other countries similar to the Canadian ELMLP, New Zealand has been a leader with its Integrated Data Infrastructure (IDI), developed by Statistics New Zealand, which links student-level education data on PSE graduates with administrative data on earnings, welfare benefits, and border crossings. The IDI has been used to study a range of post-graduation outcomes such as earnings and destination (employment, welfare, schooling, or emigration) on an annual basis over a seven-year period following graduation (Park, 2014; Park, Mahoney, Smart, & Smyth, 2014; Mahoney, 2014a; 2014b; 2014c; Mahoney, Park, & Smyth, 2013).

Figlio, Karbownik, and Salvanes (2016) report that four Nordic countries (Denmark, Norway, Sweden, and Finland) also use unique personal identifiers that allow various administrative registries to be linked, including birth, death, and education records, as well as employment records. These countries have also developed mechanisms for sharing these data with the research community for specific research projects. For instance, Kirkeboen, Leuven, and Mogstad (2016) links administrative records of all applicants

to PSE from 1998 through 2004 to the Norwegian population registry, national education registry, and tax registry to study the effect of field of study and PSE institution on labour market earnings. Bhuller, Mogstad, and Salvanes (2017) also use the Norwegian registry database to identify the causal relationship between schooling and life cycle earnings by exploiting a long period of tax record and exogenous change induced by the implementation of compulsory schooling law reform between 1960 and 1975.

Britton, Shephard, and Vignoles (2015) compare the earnings data from the 2011 and 2012 waves of the United Kingdom's Labour Force Survey (LFS) with the UK Government's administrative individual-level earnings data. They find that the LFS and administrative data generally showed a similar distribution of graduates' earnings; however, the administrative data had more time series persistence, higher top quantiles, and notably less gender earnings disparity.

The Obama Scorecard (White House, 2017) introduces the first comprehensive data on students' post-enrollment earnings in the United States, measured for a consistently defined set of students at nearly all post-secondary institutions. Moreover, the amount students must pay to attend college, the likelihood they will complete their degree, their success in the labour market, and the likelihood they will pay off their loans all depend importantly on the institution where

they choose to pursue their education.

Other studies of post-graduation earnings based on a PSE-tax linkage approach include Belfield et al. (2018) for the UK; Hastings, Neilson, and Zimmerman (2013) for Chile; Braga, Paccagnella, and Pellizzari (2014) for Italy; and Cunha and Miller (2014) for the US.⁶

⁶ Analogous to the PSE-tax data linkage approach, a number of US studies obtained post-graduation labour market earnings information from state unemployment insurance records in given states. These studies include Jepsen, Troske, and Coomes (2014); Stevens, Kurlaender, and Grosz (2015); Liu, Belfield, and Trimble (2015); and Dadgar and Trimble (2015).

3.0

Data & Analytical Approach

3.1 The Education & Labour Market Longitudinal Platform (ELMLP)

This project leverages the ELMLP, a longitudinal data platform that includes administrative data held by Statistics Canada on PSE students, including those in apprenticeship programs, and personal income tax information. The ELMLP allows researchers to address a wide range of policy-related questions pertaining to PSE, school-to-work transitions, labour market outcomes, and other related topics.

The core components of the ELMLP are three longitudinal databases: the Postsecondary Student Information System (PSIS), the Registered Apprenticeship Information System (RAIS), and the T1 Family File (T1FF).⁷

The ELMLP is not a dataset per se, but rather a relational data environment that allows users to combine the

research potential of PSIS, RAIS, and T1FF by linking across these files using a MasterID, which represents a unique person-level identifier.⁸

Postsecondary Student Information System (PSIS)⁹

PSIS consists of administrative records of PSE students, collected annually from all publicly funded colleges and universities in Canada. PSIS is thus close to a census of all students in Canadian PSE institutions, as opposed to a sample, although there are some gaps in the ELMLP's coverage, which are discussed below.

Information in PSIS includes students' programs (type of credential, Classification of Instructional Program [CIP] code, program name), institution (type, location), as well as personal characteristics such as age, gender, immigration status, and current and permanent address (Statistics Canada [n.d.], PSIS Codebook).¹⁰

⁷ The ELMLP is available in Statistics Canada Research Data Centres. Other datasets in addition to the core PSIS, RAIS, and T1FF files are being added to the ELMLP on an ongoing basis, as resources permit. For updates on the platform, go to the Canadian Research Data Centre Network (CRDCN) website.

⁸ [LMI Insights no. 4](#) provides a broad overview of the ELMLP, and [LMI Insights no. 9](#) discusses new datasets that are being processed and added to this data environment.

⁹ For information on PSIS, see Statistics Canada (n.d.) PSIS User Guide.

¹⁰ The student and program information included in PSIS is taken from the administrative data provided by PSE institutions, and the availability, quality, and completeness of this information can vary across individual PSE institutions and more generally by province and territory.

In principle, PSIS includes one record for each program in which a student is enrolled in any year, thereby including multiple records for students enrolled in more than one program in a given year, as well as multiple records across years for students who continue in a program over time as well as those enrolled in different programs in different years.¹¹

PSIS data on the ELMLP are available for all Canadian provinces and territories from the 2009–2010 reporting cycle (generally from the spring/summer semester through the end of the following winter semester) onward, and from the 2005–2006 reporting cycle onward for Prince Edward Island, Nova Scotia, and New Brunswick.

Registered Apprenticeship Information System (RAIS)¹²

RAIS consists of administrative data on registered apprentices and trade qualifiers for designated trades compiled by the provinces and territories from a variety of sources.

The RAIS information included on the ELMLP is generally similar in nature to that of PSIS, while reflecting the RAIS trades and apprenticeship orientation, and includes the trade of registration, program characteristics, and personal characteristics (the latter more limited than PSIS). In the ELMLP, RAIS data are available from 2008 onward.

The analysis presented here does not include the apprenticeship program

completers or trade qualifiers captured in RAIS, but these groups are the focus of a forthcoming report by EPRI and LMiC.

T1 Family File (TIFF)

The TIFF data on the ELMLP are taken from personal income tax returns transferred to Statistics Canada by the Canada Revenue Agency (CRA). The TIFF contains income from various sources, including employment income, income from government programs (such as Social Assistance, Employment Insurance, and the Child Tax Benefit), and various tax credits and deductions (PSE tax credits, Canada Pension Plan [CPP] and Registered Pension Plan [RPP] contributions, and union dues). Also included are personal characteristics such as age, gender, and province (Statistics Canada, 2018d). Finally, industry of employment is also available, representing the three-digit North American Industry Classification System (NAICS3).

All TIFF information is at the person (student) level except for the additional availability of some selected family-level variables, including parental income, family type, family size, and number of children.¹³ TIFF information is available for all individuals with PSIS or RAIS information on the ELMLP from 2004 onward, including the years before, during, and following enrollment in post-secondary education.

¹¹ Consistent with its relational database structure, PSIS does not explicitly link individuals across their different PSE records either within a given year or across years. Instead, individual's MasterID must be used to identify all records associated with a given individual in any given year, and then the information included in each record must be used to identify which records in later years represent the continuation of an earlier program and which represent new programs.

¹² For information on RAIS, see Statistics Canada (n.d.) RAIS User Guide.

¹³ TIFF captures census (nuclear) families, consisting of at most two generations. Depending on the situation, the "parents" may refer to the student and any spouse in a situation where they have children present, or the student's own parents when the student is living with them. The relevant variables, of course, have to be used and interpreted in this context.

Limitations of the ELMLP

The ELMLP has remarkable strengths, including its near complete representation of the population of PSE students (and graduates) in Canada, its accurate income information, and its ability to track students' earnings on a year-by-year basis following graduation separately for each cohort of graduates. However, as with any single data source, the ELMLP, in its current form, also has a number of limitations in terms of providing a complete picture of PSE student outcomes. Key limitations are described below.

Occupation: It is not possible to identify the particular occupations in which graduates find employment, nor — by extension — whether they are working in an occupation related to their education program.¹⁴

Other job characteristics, including indicators of job quality: Similarly, the ELMLP does not include other job attributes that could reflect not only the general nature of the job, but also its overall quality. For example, the ELMLP lacks information on working conditions (e.g., access to benefits) and does not have any information on the type of employment held (e.g., permanent versus temporary).

Hours/weeks worked voluntarily or involuntarily: The ELMLP has no

information on hours worked per week or weeks worked per year. The available annual earnings measure therefore does not reflect either the hours or weeks worked along with the rate of pay (hourly wage or weekly or annual salary). Nor does the ELMLP tell us if hours and weeks worked are constrained by demand-side factors (i.e., full-time, full-year work is not available).

No-PSE comparison groups: The ELMLP includes only those in the PSIS/RAIS universe, meaning the absence of comparison groups representing those who have not participated in formal PSE or apprenticeship training programs.¹⁵ The ELMLP would, however, permit comparisons of graduates with those who attended PSE but did not complete their credentials.

Limited time coverage of graduates after leaving school: Another limitation of the current ELMLP is that it allows graduates to be tracked only for the number of years permitted by the period covered by the data. In our case, the earliest full cohort of graduates finished their studies in 2010 and was followed to 2015, five years after graduation.¹⁶

Limited time in-school: Similarly, the period covered by the ELMLP is limited in terms of being able to identify individuals who obtain combinations

¹⁴ While such “job-education match” information is often sought, including by PSE ministries, which use it as a performance measure, such measures can have serious limitations, particularly in the case of graduates with more general skill sets who find jobs in a range of different occupations precisely because their skill sets have wide applicability. In general, it is often difficult to equate occupations to what PSE graduates have studied, whether that be philosophy graduates working in an occupation other than “philosopher” or engineering graduates working as, for example, “project managers.”

¹⁵ Frenette (2019a) overcomes this problem by developing a non-PSE comparison group based on a more general TIFF file and using the absence of PSE tax credits as an indicator of no PSE, and comparing their outcomes to those included in the ELMLP.

¹⁶ As discussed in [subsection 2.3](#), other PSE-tax linked studies have followed students into the labour market for longer periods; for example, Finnie et al. (2014, 2018) for 8 years, Finnie et al. (2016) for 13 years, Heisz (2001) and Oreopoulos, von Wachter, and Heisz (2012) for 22 years.

of credentials (e.g., first a college certificate or diploma and then a bachelor's degree — or vice versa) and to compare the post-graduation outcomes of graduates with these different combinations of credentials.

Limited number of graduation cohorts:

Again related to the relatively short period currently covered by the ELMLP, graduates' outcomes cannot be compared to those who graduated in years prior to the ELMLP, with the 2010 cohort being the first set of graduates included in the analysis presented here. This precludes identifying longer-run trends in graduates' earnings, or comparing the records of graduates who completed their studies at different points in the business cycle.¹⁷

Returns to PSE: Neither the direct nor opportunity costs of PSE are included, and in general are often difficult to identify precisely. It is, therefore, not currently possible to measure the rates of return to PSE using the ELMLP.

Worker skills: There is much interest in workers' specific skills ([LMiC, 2018a](#)) and the development of skills in PSE, but these are typically challenging to measure ([LMiC, 2019a](#)) and there are currently no direct measures of skills included on the ELMLP.

Non-earnings benefits of PSE: The benefits of PSE, at both the individual and social levels, go beyond earnings and other labour market outcomes and can include outcomes such as health, civic engagement, productivity, social cohesion, crime, fertility, family life, leisure time, and more. None of these are measured in the ELMLP.¹⁸

Some of these limitations may be resolved over time, at least in part, as Statistics Canada adds years and other datasets to the platform. One complication is that job characteristics are associated with specific employment situations at a given point in time, whereas earnings are reported on the ELMLP on a calendar year basis and may cover multiple jobs.

3.2 The Earnings Measure

This project focuses on total before-tax employment earnings, which are calculated by combining all paid employment income (wages, salaries, and commissions) reported on T4 slips, positive net income earned from self-employment (business, professional, commissions, farming, and fishing),¹⁹ "Indian exempt" employment income,²⁰ and other taxable employment income

¹⁷ The same PSE-tax linked studies mentioned in the previous footnote include extended numbers of cohorts that cover different points in the business cycle.

¹⁸ See also LMiC (2018b) for related discussions regarding the limitations of the ELMLP.

¹⁹ Statistics Canada (2018b) includes negative net self-employment income values. In this analysis, we convert these to zero on the grounds that labour market earnings cannot, by definition, be negative and self-employment income mixes returns to business activities and labour market earnings, further complicated by the tax treatment of self-employment income.

²⁰ For employment income to be considered "Indian exempt," the location of the employment duties is a major connecting factor, as most on-reserve work is classified as tax exempt. However, the CRA also recognizes that employees of bands, tribal councils, or organizations that operate on their behalf may perform most of their activities off reserve. If the employer is resident on a reserve and the "Indian" is employed in a non-commercial activity for the social, cultural, educational, or economic development of "Indians" who for the most part live on reserves, the income of their employees is also tax exempt. For more information on the guidelines covering "Indian exempt" employment income under Section 87 of the Indian Act, visit <https://www.canada.ca/en/revenue-agency/services/aboriginal-peoples/indian-act-exemption-employment-income-guidelines.html>.

not reported on a T4 slip, such as tips, gratuities, and net research grants (Statistics Canada, 2018c).²¹

The measure of earnings used here can thus be summarized as follows:

Earnings = employment income + positive net self-employment income + “Indian exempt” employment income + other employment income

Earnings are adjusted to constant 2016 dollars using the Canada-wide Consumer Price Index (CPI).

One important caveat of the self-employment income category is that it includes only unincorporated earnings. In some cases, however, graduates may form corporations and earnings may be transmitted through dividends, allocated to family members, or retained within the corporation. Earnings paid out in salary from the corporation to individuals themselves would, however, be included in the earnings measure as employment income.

3.3 Credential Categories

In this analysis, we focus on the following six credentials, created by combining the program and credential information included in PSIS and following conventions established by Statistics Canada (2018a):

- College-level certificate
- College-level diploma
- Bachelor’s degree
- Master’s degree

- Doctoral degree
- Professional degree

College-level certificates and diplomas are credentials associated with career, technical, and professional training programs that usually lead to specific career paths for which the entry requirement is typically a secondary school diploma. Certificate programs typically require one year (two semesters) of full-time study, whereas diplomas require two or three years (four or six semesters) of study.

Bachelor’s degrees include applied degrees, but associate degrees are excluded.²² To account for jurisdictional differences in education and social work programs, degrees in post-baccalaureate non-graduate programs in these fields (e.g., teacher’s college) are also included along with those programs typically accessed directly from high school.

Master’s and doctoral degrees capture graduate degrees in all disciplines, including business (e.g., MBA). Professional degrees include bachelor’s and post-baccalaureate non-graduate programs in law (LLB, JD, BCL), medicine (MD), dentistry (DDS, DMD), veterinary medicine (DVM), optometry (OD), and pharmacy (PharmD, BS, BSc, BPharm).

MBA’s are often considered to be professional programs but they represent formal graduate degrees, which differentiates them from the other professional degrees defined here, which are post-baccalaureate non-graduate degrees.

²¹ For different approaches to calculating earnings in the ELMLP, see LMIC (2019b).

²² Associate degrees are specific to British Columbia and are two-year undergraduate academic credentials, thus significantly differentiating them from standard bachelor’s degrees.

Bachelor's and graduate degrees that are sometimes considered to be "professional" degrees, but are not post-baccalaureate non-graduate degrees (e.g., Bachelor of Engineering) are categorized under their relevant credential level (e.g., bachelor's degree; Statistics Canada, 2018c). Similarly, degrees that lead to other professional certifications, such as Certified Professional Accountant (CPA), are not included in the professional degree category.

The order in which these credentials are listed and presented below follows Statistics Canada (2018b) and generally reflects the total years of schooling required to complete each credential, the one exception being professional degrees.

In some cases, certain credentials can be awarded by either colleges or universities (e.g., colleges can award a bachelor's degree and universities can award college-level diplomas). This analysis does not differentiate credentials by the type of institution awarding them.

The Canadian post-secondary landscape is quite complex, varies across jurisdictions, and includes more types of credentials than the six used in this analysis. The six selected credentials studied here, however, reflect the classification of programs and credentials used by Statistics Canada (2018a) and represent the vast majority of credentials awarded in the country.

A range of specific education qualifications, such as graduate certificates, undergraduate qualifying credentials, advanced certificates, and certain diploma programs requiring a minimum of a baccalaureate degree for entry are not included in this analysis as they do not fit into the six selected credential categories, are not necessarily uniformly defined, and for the most part represent a small number of graduates.

3.4 Field of Study Categories

Field of study is the organizing principle behind the Classification of Instructional Programs (CIP) Canada 2011. The structure of CIP consists of three hierarchical levels of programs: (1) the general grouping containing 49 series of two-digit codes; (2) the intermediate groupings are identified by 387 subseries of four-digit codes; and (3) the most detailed level contains 1,689 instructional program classes.²³ Note that the CIP groupings are independent of credentials.

A variant of 13 primary groupings of CIP has been developed jointly by Statistics Canada and the National Center for Education Statistics (see [Box 1](#)). This variant is often used for the analysis of data at a highly aggregated level. In this analysis, we focus on 11 of these primary groupings:²⁴

²³ For more details, see the overview on [Statistics Canada's website](#).

²⁴ Two field of study groups are removed: 1) Personal improvement and leisure as it includes "not-for-credit" programs and this analysis focuses exclusively on for-credit post-secondary programs and 2) "Others" as that category includes a variety of different programs some of which a preparatory and others are non-PSE programs.

Full Name of Field of Study	Short Form	Label
Education	Education	EDUC
Visual and performing arts, and communications technologies	Arts	ARTS
Humanities	Humanities	HUM
Social and behavioural sciences and law	Social Sciences	SOCL
Business, management and public administration	Business	BUS
Physical and life sciences and technologies	Sciences	SCI
Mathematics, computer and information sciences	Math & Computer Science	MATH
Architecture, engineering, and related technologies	Engineering	ENGR
Agriculture, natural resources and conservation	Natural Resources	NATR
Health and related fields	Health	HLTH
Personal, protective and transportation services	Personal & Protective Services	PPTS

Box 1. STEM & non-STEM Fields of Study

Earnings of PSE graduates tend to be discussed in terms of two broad categories: STEM (science, technology, engineering, and mathematics) and other fields of study known by the acronym BHASE (business, humanities, arts, sciences, and education). We do not follow this approach because the STEM and BHASE categories are exceedingly broad, combining graduates from very diverse fields of study with different earnings levels. We instead provide a more detailed field of study analysis using the eleven primary field of study categories defined in the 2011 Classification of Instructional Programs (CIP) codes.

Note that the eleven fields of study discussed here cannot be grouped into the broader STEM and BHASE categories. For example, some Health graduates

would be in BHASE (e.g., medical, nursing, and optometry degree holders), while others would be in STEM (e.g., biomedical, physics, and medical science graduates).

Nevertheless, since the STEM-BHASE categorization is often employed, we present findings using these breakdowns in the Appendix and on our interactive dashboard. The STEM disciplines taken as a whole have higher earnings than the BHASE disciplines for college-level certificate and diploma and bachelor's degrees graduates, while BHASE graduates with master's and doctoral degrees earn more than their STEM colleagues.

Two field of study groupings are removed from the analysis: 1) Personal improvement and leisure as it includes “not-for-credit” programs and this analysis focuses exclusively on for-credit post-secondary programs and 2) “Others” as that category includes a variety of different programs some of which a preparatory and others are non-PSE programs.

The full fields of study categories used in the analysis are referred to by their short forms (shown above) to allow for more concise language. The labels shown are used to annotate the graphs.

The 13 CIP primary groupings consist of series and subseries presented on [Statistics Canada’s website](#).

3.5 Analytical Approach

This project aims to provide strategically important labour market information to a wide range of PSE stakeholders, including students, institutions, policy makers, researchers, and the general public.²⁵

The objective is to provide a new and detailed picture of Canadian college and university graduates’ earnings

— all graduates at all publicly funded PSE institutions in Canada — following each cohort after graduation by using annual tax data. To this end, we track graduates’ annual employment earnings on a year-by-year basis starting with the first full year following graduation. For the 2010 graduating cohort, for example, their annual earnings are reported from 2011 forward. For this cohort, information is available for five years, from 2011 through 2015, while later cohorts have fewer years of earnings information available. This is done separately for each graduating cohort ([Table 1](#)) and by credential.

We mainly focus on graduates’ mean earnings, but also present median earnings along with other selected percentile points (10th, 25th, 75th, and 90th) to investigate the distribution of earnings across graduates. While some studies of graduates’ labour market outcomes focus on median earnings (e.g., Statistics Canada, 2018b), a comparison of the trajectories of mean and median earnings presented in [section 4.1](#) shows that they are generally similar.

This analysis is intended to simply track the earnings of graduates and present them descriptively as opposed to

Table 1: Graduation Date and Tax Year Structure

	Tax year 2011	Tax year 2012	Tax year 2013	Tax year 2014	Tax year 2015
Cohort 2010	Year 1	Year 2	Year 3	Year 4	Year 5
Cohort 2011		Year 1	Year 2	Year 3	Year 4
Cohort 2012			Year 1	Year 2	Year 3
Cohort 2013				Year 1	Year 2
Cohort 2014					Year 1

²⁵ The project focuses only on PSE graduates and does not include non-PSE completers. Non-completers represent a widely diverse group, including their varying number of years in PSE, which leads to divergent labour market outcomes. Future work on non-completers is planned.

investigating the relationship between earnings and any particular set of student or program characteristics, as well as other factors such as local labour market conditions.²⁶ In addition, results cannot be interpreted as the causal effects of credentials or fields of study on earnings since individuals self-select their credentials, fields of study, and other aspects of their schooling, while institutions have different admission requirements across programs offered. These selection processes generally correlate with student ability and other individual factors that have their own effects on earnings outcomes. As with most studies of this type, these cannot be controlled for using the analytical approach used here. Also, as referred to above, since TIFF does not include information on hours or weeks worked, the analysis cannot adjust graduates' earnings for labour supply decisions and related factors. All results follow Statistics Canada's disclosure rules.

3.6 Sample Selection

To construct the sample of graduates used in this analysis, we first search

across all PSIS records from 2009–2010 to 2014–2015 and select records with a graduation flag. We constructed five cohorts of graduates according to the calendar year of graduation, from 2010 to 2014.²⁷ Due to the comprehensive coverage of PSIS, in principle this should represent the entire population of PSE graduates in Canadian publicly funded institutions over this period.²⁸ A small number of institutions did not provide information on their students to Statistics Canada in certain years and are, therefore, not included in PSIS or in our sample.²⁹ When students are observed to be graduating from multiple programs in a given year, we have applied the same four-step process for same-cohort multiples adopted by Statistics Canada and included only one record per graduate for a given cohort.³⁰ The very few records with missing PSIS information on gender, immigration, age at graduation, and program end date are also excluded (0.4%). We also restricted the sample to graduates from the ten Canadian provinces and those aged 15 to 64 at graduation (removing 1% of the sample).³¹

²⁶ An important next step for this line of research would be to use regression and other more sophisticated analytical frameworks to identify the contribution of various factors of this type to the observed earnings patterns, and to identify earnings patterns by credential after controlling for such influences. The initial descriptive analysis presented here, however, provides a natural starting point for this type of research.

²⁷ Because of the reporting cycle structure of PSIS, two successive reporting years are needed to identify all graduates in a given calendar year. For example, the 2010 cohort of graduates is identified in the 2009–2010 and 2010–2011 PSIS records.

²⁸ A small number of records were dropped because of missing MasterIDs (0.4%) and another small number of records were dropped because they were in non-PSE programs, not-for-credit PSE programs, and very short PSE programs (1.5%).

²⁹ This issue is particularly pronounced for Ontario colleges where 8 to 14 colleges out of 24 are missing from 2009 to 2014, although this improved in 2015 (Statistics Canada [n.d.] PSIS User Guide).

³⁰ Step 1: Choose the record associated with the highest program type (based on the defined ranking over program type categories). Step 2: If there is more than one record with the highest program type, choose a record associated with the highest credential type to break the tie (based on the defined ranking over credential type categories). Step 3: If an individual obtains more than one education qualification at the highest program and credential type in a single calendar year, and one of them is associated with CIP series 13 (Education), select this record to break the tie. Step 4: If steps 1–3 do not resolve the tie, randomly choose one graduate record from same cohort multiples (Statistics Canada, 2018c). Approximately, 2.5% of graduate records are dropped because of this four-step selection rule.

³¹ Due to data gaps, Yukon, Northwest Territories, and Nunavut are not included in the analysis. Virtually no graduates are available in the 2010 cohort, the focus of this report, and there are just over 800 graduates in total observed across all of the territories across all five of the cohorts covered in this analysis.

Once graduate records are selected from PSIS, they are merged with the T1FF data to track graduates' earnings through 2015, the latest year available in the T1FF at the time of this study. Overall, 90.7% of graduates were linked to at least one year of post-graduation tax data.³²

Three additional sample restrictions are imposed. First, individuals who do not file taxes in a given year are excluded for that year but are included for all other years (both before and after) for which their tax information is available to keep the samples as inclusive and representative as possible.

Second, individuals are also excluded from the analysis if they are identified as pursuing further full-time PSE in any given year (identified through the full-time PSE education tax credit information included in T1FF) and for all subsequent years thereafter. This restriction is imposed because further schooling typically leads to less active engagement in the labour market while the individual is in school, and new skills or credentials acquired following a return to school could lead to new earnings patterns upon labour market re-entry.³³ If an individual is observed to have earned another credential, they can be reintroduced into the sample as a new graduate associated with that new credential and followed from that point of graduation forward.³⁴ To give a

specific example, consider an individual who obtains a bachelor's degree in 2010, works for a year then returns to school full-time to pursue a master's degree in 2012, graduating in 2013. In this case, their earnings from the 2011 tax year are included in the analysis for their bachelor's degree, but not in later years until the individual is reintroduced as a master's graduate in the 2014 and 2015 tax years.

While we control for further education, the full-time education deduction variable in the T1FF does not allow us to identify all graduates who pursue practical training associated with certain professional credentials (e.g., articling for law or medical residencies). Such individuals will, therefore, be included in the sample while they are still completing their training when their earnings are generally lower than after the full completion of their training. The data similarly do not identify doctoral degree graduates who obtain post-doctoral appointments.

Third, in order to focus on graduates who are meaningfully engaged in the labour market, those whose total before-tax earnings are lower than \$1,000 in a given year are excluded from the sample for that year. When individuals with earnings under \$1,000 are included, average earnings generally shift slightly downward, while the earnings trajectories and the

³² The number is very similar to the linkage rate of Statistics Canada's (2018c) sample (i.e., 90%).

³³ The further PSE restriction could also have been based on the PSIS enrollment file, but we decided to use the full-time PSE education tax credit to be consistent with Statistics Canada (2018c).

³⁴ Individuals pursuing PSE part-time remain in the sample until they are observed to graduate with a new credential since part-time education allows them to remain in the labour market; the earnings of part-time PSE returners are similar to those of non-returners.

³⁵ The mean earnings of doctoral degree graduates shift down relatively more than other graduates when low earners are included. This could reflect the higher rate at which they live outside of the country after graduation and/or post-doctoral appointments, for which earnings can constitute non-taxable income. The shape of the earnings trajectory is, however, very similar.

relative patterns across the different sets of graduates remain essentially unchanged, as presented in the [Appendix](#).³⁵

Some studies (e.g., Statistics Canada, 2018b) opt for a balanced panel approach, where students excluded based on any of the three restrictions in any year are removed from the entire analysis in all years. We have conducted tests comparing our approach with a balanced panel approach, the results of which are presented in the [Appendix](#). The earnings trajectories with the balanced approach shift up (i.e., earnings are higher) but remain approximately parallel, thereby indicating similar patterns of earnings growth over time. The general patterns of earnings are, therefore, consistent using the two approaches.

Finally, a forthcoming EPRI-LMiC report will analyze earnings of registered apprentices.

3.7 Sample Characteristics

[Table 2](#) presents the number of graduates and the distribution by credential for each graduating cohort. The total number of graduates increased from 326,920 in 2010 to 372,670 in 2014.

The distribution by credential across cohorts is very consistent. Bachelor's degrees account for nearly half of the credentials awarded, followed by college-level diplomas with nearly a quarter (23%). College-level certificates and master's degrees each account for 12-13% of credentials awarded, while professional and doctoral degrees account for only a very small proportion (about 2% each).

[Table 3](#) shows the provincial distribution of the number of graduates by credential. Ontario is by far the largest source, with approximately 780,000 PSE graduates in the five-year period studied. Quebec is the second largest source with fewer than half the number for Ontario (330,000).

Table 2: The Number and Distribution of Graduates by Credential and Cohort³⁶

Distribution (count) and Distribution (%) by credential and province							
Cohort	Number of Graduates	College-Level Certificate	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree	Professional Degree
2010	326,920	12.7	22.1	48.4	12.6	1.7	2.5
2011	357,480	12.7	22.5	49.1	11.7	1.6	2.4
2012	357,730	12.3	23.1	48.1	12.4	1.7	2.4
2013	371,090	11.9	22.6	48.4	12.9	1.8	2.4
2014	372,670	11.8	23.4	48.2	12.5	1.7	2.4

³⁵ The mean earnings of doctoral degree graduates shift down relatively more than other graduates when low earners are included. This could reflect the higher rate at which they live outside of the country after graduation and/or post-doctoral appointments, for which earnings can constitute non-taxable income. The shape of the earnings trajectory is, however, very similar.

³⁶ Due to data inconsistencies, almost half of Ontario colleges are missing from the ELMLP between 2009 and 2014. The numbers reported here differ slightly from what Statistics Canada (2018c) reports using the ELMLP due to our inclusion of the Ontario colleges available on the platform, whereas Statistics Canada removes all Ontario college graduates from their analysis.

Table 3: The Number and Distribution of Graduates by Credential across Provinces, All Cohorts

Distribution (count) and Distribution (%) by credential and province							
Province	Number of Graduates	College-Level Certificate	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree	Professional Degree
Newfoundland & Labrador	26,710	19.2	18.9	45.6	13.1	1.2	1.9
Prince Edward Island	9,730	27.9	30.5	34.1	4.1	0.3	3.1
Nova Scotia	65,010	13.8	16.3	50.5	15.6	0.8	3.0
New Brunswick	36,830	21.3	14.4	53.5	8.7	0.7	1.4
Quebec	329,980	0.0*	27.7	48.4	17.4	2.6	3.9
Ontario	781,190	8.7	24.3	51.1	12.1	1.7	2.1
Manitoba	46,910	18.3	13.1	56.8	7.6	1.2	3.0
Saskatchewan	44,230	25.8	9.9	47.1	11.7	1.4	4.2
Alberta	190,390	17.2	26.7	42.9	9.3	1.8	2.1
British Columbia	254,920	29.0	15.5	42.9	10.1	1.3	1.2
All Provinces	1,785,900	12.3	22.7	48.4	12.4	1.7	2.4

* Note: The absence of college-level certificate graduates in Quebec reflects their different system of post-secondary education.

British Columbia and Alberta follow with 255,000 and 190,000 graduates, respectively, while all other provinces have fewer than 70,000 graduates. For each province, bachelor's degrees are the most commonly awarded credential, although its share varies from 34.1% in Prince Edward Island to 56.8% in Manitoba. The second largest group is either college-level certificates or diplomas, depending on the province. Master's degrees account for substantially different shares across provinces, from 4.1% in Prince Edward Island to 17.4% in Quebec. Doctoral and professional degrees are the two smallest credential categories in every province, ranging from 0.3–2.6% and 1.2–4.2%, respectively.

Figure 1 presents the proportions of graduates excluded due to the three sample restriction conditions discussed above (i.e., non-tax filer, further PSE, and low-earnings threshold) by year following graduation for each credential

for the 2010 cohort. These are shown as the percentage of the original sample remaining after each of the sample restrictions is imposed sequentially. The three sample restriction conditions together affect the bachelor's degree sample the most, with 43% of bachelor's degree graduates excluded from the sample in the first year after graduation, rising to 56% in the fifth year after graduation.

The non-filer exclusion includes those who are not matched to tax data, representing approximately 10% of the graduate sample, as discussed earlier. The non-filer exclusion has greater effects on the samples of bachelor's, master's, and doctoral degrees than other credentials.

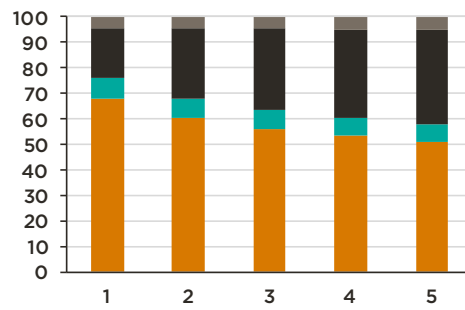
For all credentials except for doctoral degrees, the proportion of graduates affected by this exclusion condition is stable over the five-year period after graduation.³⁷

Figure 1: Sample Restrictions by Years Since Graduation, 2010 Cohort (%)³⁸

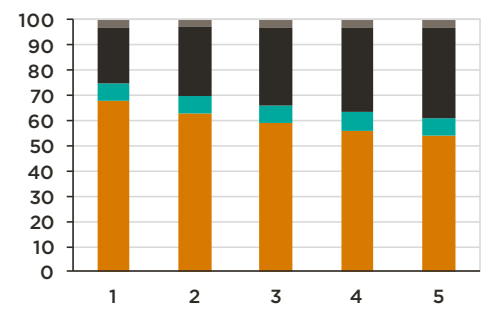
LEGEND

- ANALYSIS SAMPLE
- NON-FILER
- FURTHER EDUCATION
- LOW INCOME

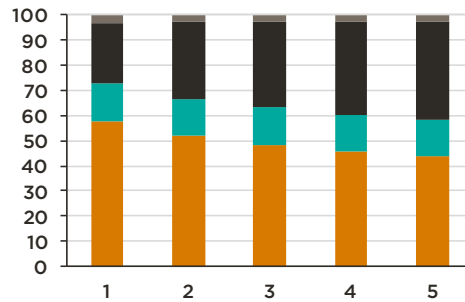
College-level Certificate



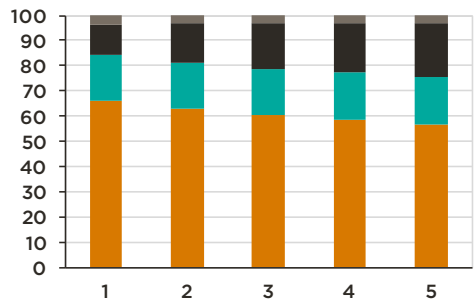
College-level Diploma



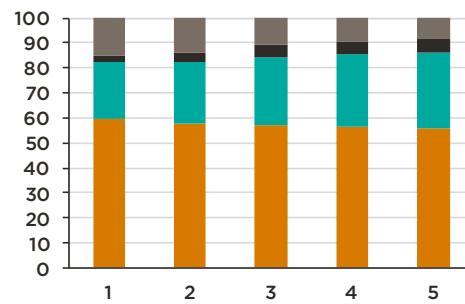
Bachelor's Degree



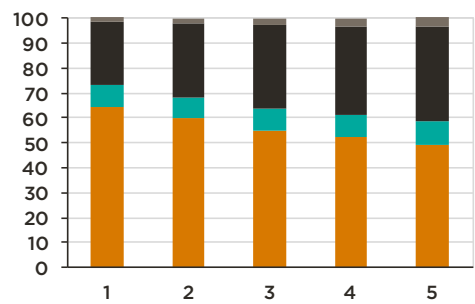
Master's Degree



Doctoral Degree



Professional Degree



³⁷ This high non-filing rate could be, at least in part, due to students leaving the country after graduation. Half of the non-filers in the PhD sample are international students. This is discussed further below.

³⁸ The associated numbers are reported in the [Appendix](#).

Not surprisingly, the effects of the further education exclusion are smaller for master's and doctoral degrees than for other credentials, particularly for doctoral degrees, where the proportion of the sample excluded due to this condition is at most 6%. In contrast, this exclusion affects approximately 20% of college-level certificate and diploma graduates in the first year following graduation, and approximately 35% in the fifth year following graduation. The effect is even larger for bachelor's and professional degree graduates, at approximately 25% and 38% in the first and fifth year following graduation, respectively.

The low-earnings exclusion affects a small proportion of graduates except for those with doctoral degrees, where the proportion of graduates excluded due to this restriction is 15% in the first year since graduation and stays above 8% over the five-year period following graduation.

A possible cause for this may be the sizeable number of doctoral degree graduates who go on to post-doctoral appointments, with their post-doctoral

fellowships often treated as non-taxable income.³⁹

Table 4 shows the number of graduates included in the analysis sample for each year following graduation for the 2010 cohort by credential. For each credential, the number of earnings records available for the analysis is substantial. Even for doctoral degree graduates, there are more than 3,000 records in each year.

Table 5 presents summary statistics for the final sample of the 2010 cohort. These are discussed in the related subsections in Section 4.0.

Table 4: Final Sample, 2010 Cohort

PSE Credential	Years Since Graduation				
	1	2	3	4	5
College-level certificate	28,300	25,130	23,380	22,170	21,130
College-level diploma	49,010	45,120	42,430	40,420	38,850
Bachelor's degree	90,860	82,250	76,670	72,470	69,160
Master's degree	27,340	25,960	24,960	24,140	23,450
Doctoral degree	3,420	3,290	3,280	3,240	3,210
Professional degree	5,140	4,790	4,380	4,210	3,970

³⁹ Non-taxable income is not reported in the subset of TIFF variables currently available on the ELMLP, but could conceivably be added. Furthermore, while some post-doctoral appointments could potentially be captured in PSIS, they can represent many different arrangements, including formal postdocs paid by grants, industry-sponsored positions, or an employment relationship with the university, none of which would be consistently reported either through TIFF or PSIS.

Table 5: Summary Statistics, 2010 Cohort, Final Sample (One Year after Graduation)

	College-Level Certificate	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree	Professional Degree
All	28,300	49,010	90,860	27,340	3,420	5,140
<i>Gender (%)</i>						
Female	56	58	61	58	47	60
Male	44	42	39	42	53	40
<i>International Student Status (%)</i>						
Canadian	98	94	96	92	92	-
International	2	6	4	8	8	-
<i>Field of Study (%)</i>						
Education	4	3	17	13	7	-
Arts	3	7	4	2	-	-
Humanities	2	1	7	4	9	-
Social Sciences	5	11	18	12	21	44
Business	14	26	23	31	4	-
Sciences	-	1	5	5	22	-
Math & Computer Science	2	3	2	5	7	-
Engineering	27	18	9	12	20	-
Natural Resources	2	2	1	3	-	-
Health	30	20	13	13	9	56
Personal & Protective Services	12	8	-	-	-	-

4.0

Earnings of Post-Secondary Graduates

In this section, we present the post-graduation earnings of students.⁴⁰ The focus is exclusively on students who graduated in 2010 and are followed in the labour market for the longest period (i.e., five years).⁴¹ We begin by examining the earnings of all graduates taken together at the credential level in order to provide an initial overview of PSE graduates' earnings. We then explore differences in earnings across fields of study within each credential for all graduates. This is followed by the analysis of earnings by gender and by international student status, again first at the credential level and then by field of study. Taken together, these different sets of findings provide both broad and detailed perspectives of Canadian PSE graduates' post-schooling earnings along a number of interesting and important dimensions.

We emphasize that the observed differences across credentials and fields of study should not be interpreted as their causal effects on earnings, as discussed in [Section 3.4](#), and the

earnings reported do not necessarily represent what any individual would receive after graduating. This analysis is intended instead simply to track, present, and discuss the earnings of graduates in a descriptive manner.

4.1 Earnings of All Post-Secondary Graduates by Credential & Field of Study

Earnings by Credential

This subsection presents the earnings of students who graduated in 2010 by credential, including average⁴² earnings levels on a year-by-year basis following graduation, earnings growth rates, and distribution of earnings.⁴³ All results presented here — and those throughout this report — can be consulted using the [interactive dashboard](#) found on the LMIC-EPRI project page, along with additional related materials.

⁴⁰ Confidence intervals for all of the findings reported below, reflecting the statistical significance of the earnings values shown, are presented in the [Appendix](#).

⁴¹ The findings for the 2010 cohort are very similar to those of the other cohorts (2011-2014) included in the analysis, which can be accessed on our [interactive dashboard](#).

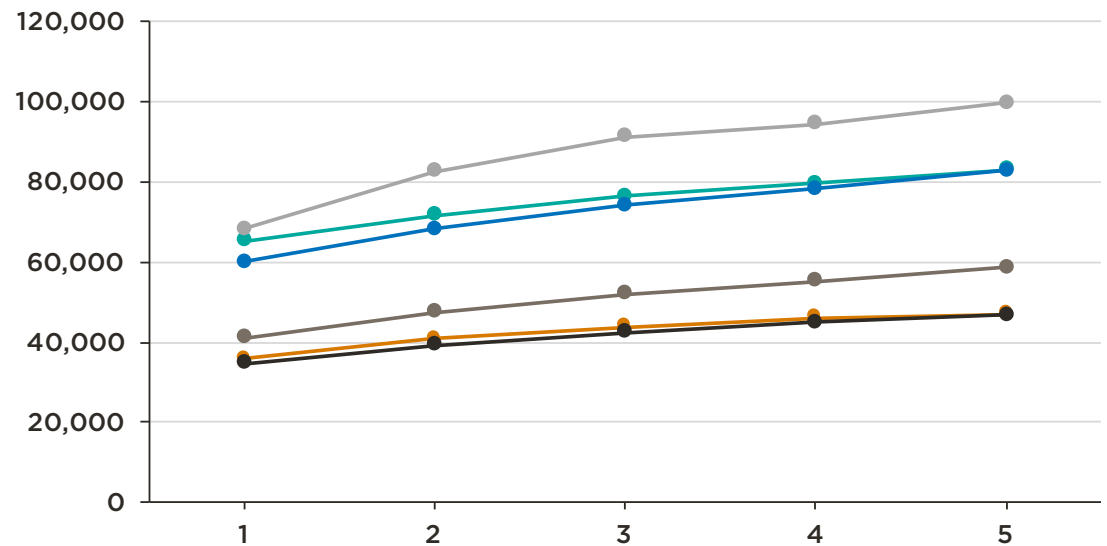
⁴² Throughout the report, average refers to the arithmetic mean, although selected medians (and other percentiles) are also shown.

⁴³ All earnings values presented in this report are adjusted for inflation and presented in 2016 dollars.

Figure 2: Average Earnings of PSE Graduates by Credential (2016 Constant \$)

LEGEND

- COLLEGE-LEVEL CERTIFICATE
- COLLEGE-LEVEL DIPLOMA
- BACHELOR'S DEGREE
- MASTER'S DEGREE
- DOCTORAL DEGREE
- PROFESSIONAL DEGREE



Earnings Levels Over Time

Figure 2 presents the average earnings of graduates in the years following graduation for each post-secondary education (PSE) credential.^{44,45} College-level certificate and diploma graduates follow very similar trajectories in their post-graduation earnings, starting at approximately \$35,000 and reaching \$47,000 five years after graduation. Average earnings are higher for bachelor's degree graduates, starting at \$41,100 in the first year after graduation and increasing to \$58,700 five years after graduation. For master's and

doctoral degree graduates, average earnings start at \$65,200 and \$60,100, respectively, then follow roughly similar trajectories, with both reaching approximately \$83,000 in the fifth year.

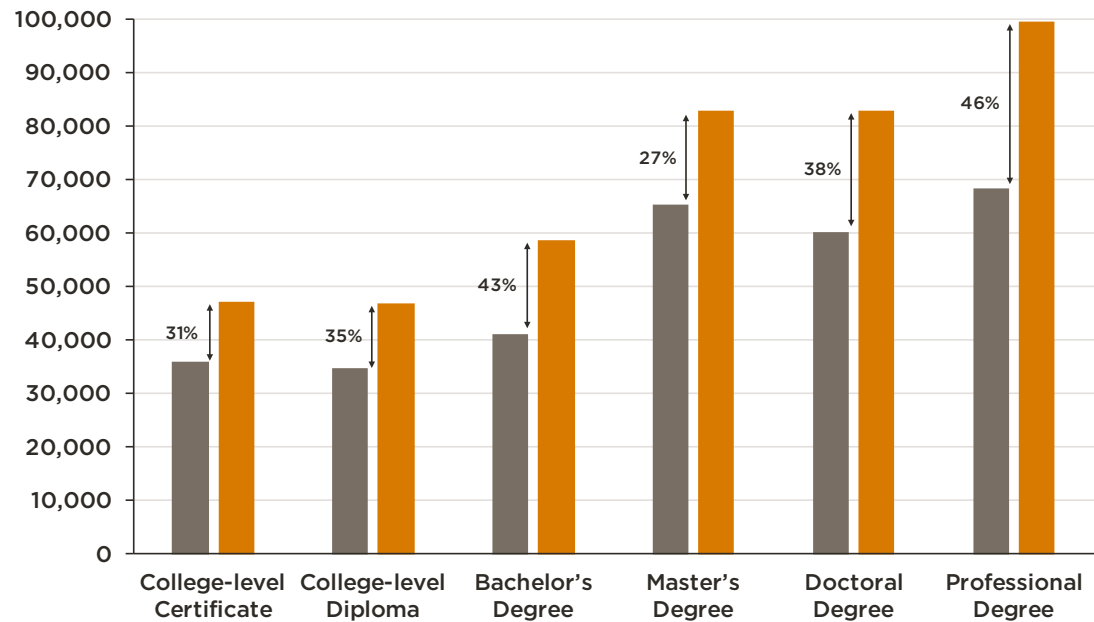
The relatively high earnings of master's graduates are driven by Business graduates (including MBA graduates), who earn substantially more than other master's graduates and represent approximately one-third of the entire master's sample.⁴⁶ This is discussed further in the fields of study sections on master's and doctoral degree graduates.

⁴⁴ The order in which these credentials are presented follows Statistics Canada (2018b) and generally reflects the total years of schooling required to complete each credential, including other PSE credentials typically required to enter a program (e.g., having a bachelor's degree before entering a master's program).

⁴⁵ A comparison of average (arithmetic mean) and median earnings (presented in the [Appendix](#)) shows that they are generally similar. Median earnings are also presented in the distribution sections.

Figure 3: First and Fifth Year Average Earnings and Percentage Growth of PSE Graduates by Credential (2016 Constant \$)

LEGEND



Professional degree graduates, who represent post-baccalaureate, non-graduate degree graduates — such as doctors, lawyers, dentists, and pharmacists — have the highest earnings, starting at \$68,300 and rising to approximately \$99,600 in the fifth year following graduation.⁴⁷ The full set of earnings results by credential can be explored on the [interactive dashboard](#).

When looking at all graduate cohorts identified in the data, all five cohorts — i.e., the students graduating in each year

from 2010 to 2014 — have similar initial earnings levels and growth over time ([see dashboard](#)).

Earnings Growth

Comparing earnings one and five years after graduation, [Figure 3](#) shows that earnings increase substantially for all credentials. Professional degree graduates have the greatest growth in earnings (46%) followed by bachelor's degree (43%) and doctoral degree holders (38%). College-level

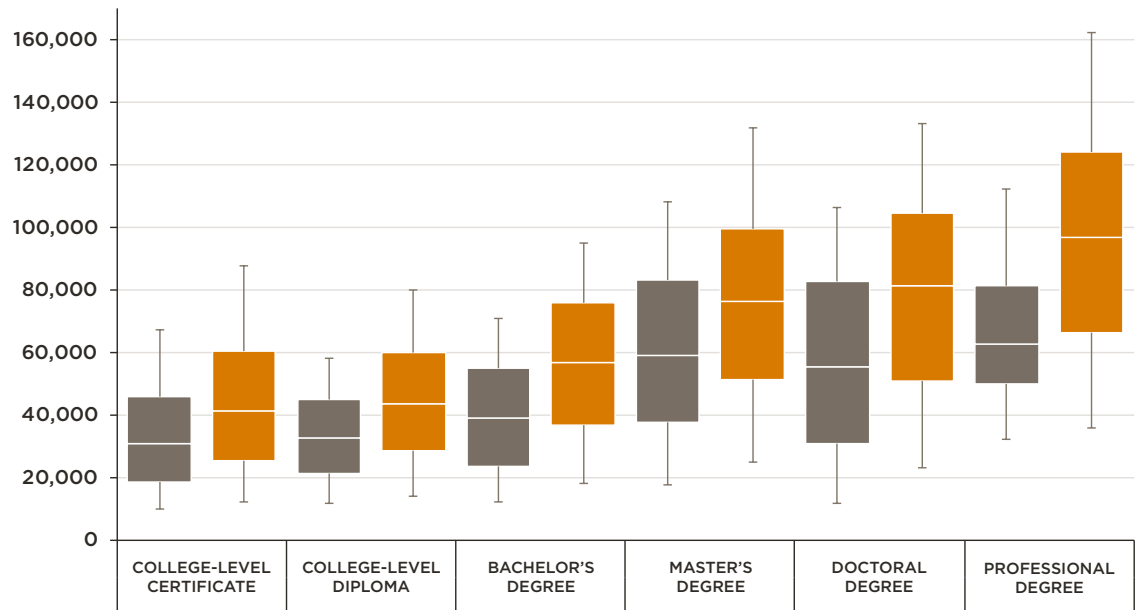
⁴⁶ The [Appendix](#) presents earnings for three groups of master's degree graduates: 1) all graduates, 2) Business graduates, and 3) all graduates without Business. In addition, [Figure 17](#) presents earnings by credential for each field of study, showing the high earnings of master's graduates in Business and that doctoral degree graduates earn more than master's graduates within each specific field of study. Reasons for including Business graduates in the master's degree credential group are discussed in [Section 3.3](#).

⁴⁷ Professional degree holders may be more likely to self-incorporate than other graduates, and since corporate income is not available on the ELMLP, it is not captured in the earnings measure used in this analysis. Consequently, the results presented may not reflect the true earnings of professional degree graduates relative to those with other credentials. The earnings of professional degree graduates may also reflect the lower earnings of graduates articling in law or completing their medical residencies, which we are unable to capture using the ELMLP, again as discussed in [Section 3.5](#).

Figure 4: Select Earnings Percentiles (10th, 25th, 50th, 75th and 90th) for PSE Graduates by Credential (2016 Constant \$)

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION



diploma and college-level certificate graduates earn, respectively, 35% and 31% more in their fifth year after graduation compared with their first year. The growth rate for master's degree graduates is the lowest (27%), although they start with relatively high first-year earnings and remain the second-highest earners, along with doctoral degree holders, five years after graduation. These growth figures translate into average annual growth rates of 7.0% for college-level certificates; 7.8% for college-level diplomas; 9.3% for bachelor's degrees; 6.2% for master's degrees; 8.3% for doctoral degrees; and 9.9% for professional degrees. Taken all

together, PSE students who graduated in 2010 experienced real average earnings growth of 8.3% per year (38% in total) between 2011 and 2015.

Distribution of Earnings

Average earnings, as presented so far, represent highly useful information and provide for meaningful comparisons, but they mask how different graduates within each credential fare. With that in mind, [Figure 4](#) presents the distribution of earnings across graduates within each credential. Specifically, the 10th, 25th, 50th (i.e., median), 75th, and 90th percentiles of earnings levels in the first and fifth year following graduation are shown.⁴⁸

⁴⁸ Percentile values are calculated for each year following graduation independently, and individuals may change their positions in the earnings distributions from one year to another. For example, an individual who is at the 10th percentile of earnings distribution in the first year after graduation could be at the 50th or 75th percentile in any subsequent year.

The tips of the top and bottom brackets capture the 90th and 10th percentiles, respectively. The upper, middle, and lower lines of the box represent the 75th, 50th, and 25th percentiles.

Percentiles represent specific points in the earnings distribution, which orders graduates from lowest to highest earnings levels. For example, the value of earnings at the 10th percentile indicates that 10% of graduates earn that amount or less and 90% earn more.

Figure 4 shows that for each credential, there are sizable differences in the earnings of graduates at the lower and higher ends of the distribution. Credentials associated with higher average earnings (namely, professional, doctoral, and master's degrees) have wider distributions of earnings across graduates.

The spread between the lowest (10th percentile) and highest (90th percentile) earners is \$80,200 for professional degrees, \$90,800 for master's degrees, and \$94,900 for doctoral degrees in the first year after graduation. In all cases, the differences between the highest and lowest earners increase over time, reaching a difference of \$126,700 for professional degree holders five years after graduation, and \$106,800 and \$110,100 for master's and doctoral degree holders, respectively. Although the absolute spreads between the highest and lowest earnings percentiles among the three other credentials are smaller, they too increase substantially over time. The spreads of college-level certificate and bachelor's degree graduates increase from approximately

\$58,000 to \$76,000 between the first and fifth year following graduation. The earnings differential between the highest and lowest college-level diploma holders starts at \$46,300 in year one and rises to \$65,900, representing the smallest spread among all credentials.

Not only do the dollar differences between the top (90th percentile) and bottom (10th percentile) widen for all credentials, but the relative differences (the ratio of earnings at the 90th percentile to earnings at the 10th percentile) are relatively stable over time. Therefore, the earnings growth rates are similar for graduates at the higher and lower ends of the earnings distribution. These wide spread in earnings levels within each credential means that the distributions generally overlap across credentials. That is, credentials with higher average earnings also have substantial numbers of graduates with relatively low earnings, and vice versa, further demonstrating the importance of looking beyond average or median earnings.

The earnings levels at the lower end of the distribution are potentially of concern. As discussed in [Section 3.1](#), however, a number of critical factors cannot be accounted for in the ELMLP that could help explain some of these low earnings outcomes, particularly the absence of hours or weeks worked.

Earnings by Field of Study

This subsection presents the earnings levels, earnings growth rates, and earnings distributions by field of study within each credential. Not all fields of study can be reported for each

Table 6: Fields of Study with Sufficient Sample Sizes by Credential

	College-Level Certificate	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree	Professional Degree
Education	✓	✓	✓	✓	✓	✗
Arts	✓	✓	✓	✓	✗	✗
Humanities	✓	✓	✓	✓	✓	✗
Social Sciences	✓	✓	✓	✓	✓	✓
Business	✓	✓	✓	✓	✓	✗
Sciences	✗	✓	✓	✓	✓	✗
Math & Computer Science	✓	✓	✓	✓	✓	✗
Engineering	✓	✓	✓	✓	✓	✗
Natural Resources	✓	✓	✓	✓	✗	✗
Health	✓	✓	✓	✓	✓	✓
Personal & Protective Services	✓	✓	✗	✗	✗	✗

credential due to small sample sizes and Statistics Canada's disclosure rules. [Table 6](#) shows which individual fields of study are available.⁴⁹

COLLEGE-LEVEL CERTIFICATES

As seen above, taken all together, college-level certificate graduates earn an average of \$35,900 one year after graduation, increasing by \$11,200 to reach \$47,100 in the fifth year, a growth rate of 31%, or 7.0% on an annual basis. Earnings of these graduates, however, differ quite substantially by field of study, as seen in [Figure 5](#). Note that because of sample size restrictions, earnings for Science graduates are not reported for this credential.

In the first year following graduation, Engineering graduates have the

highest earnings and Business, Math & Computer Science, and Natural Resources graduates also earn more than the credential average, while Health, Education, Social Science, Personal & Protective Services, Arts, and Humanities graduates earn below the average. Five years after graduation, this general ordering still holds, with the notable exceptions that Natural Resources graduates now have earnings below the credential average and Personal & Protective Services graduates have moved up substantially over time (but remain under the credential average).

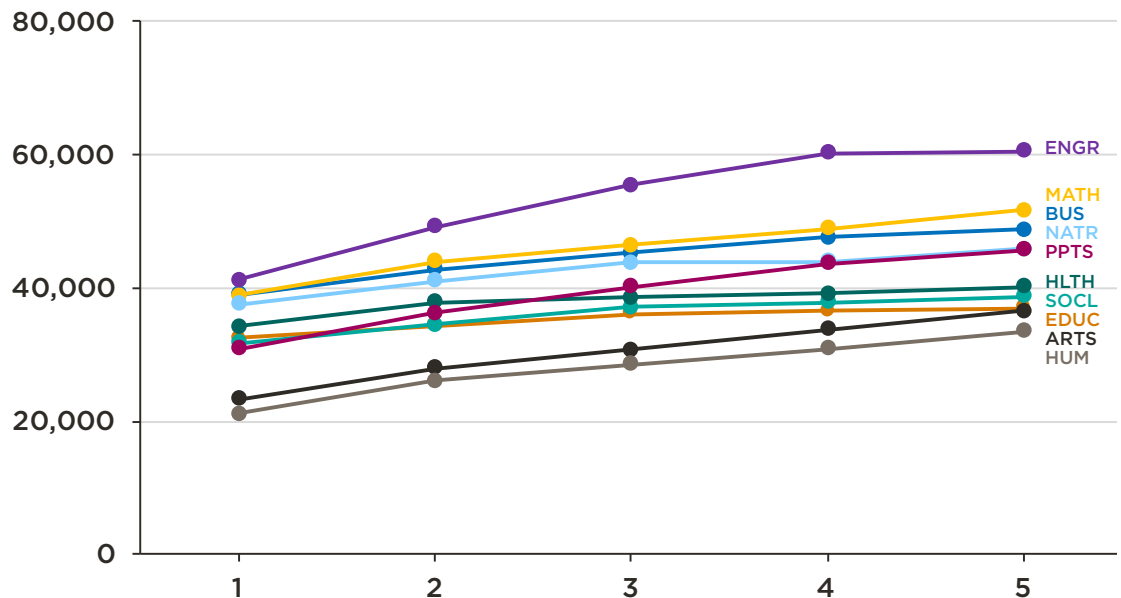
More specifically, Engineering graduates have by far the highest earnings at \$60,500, followed by Math & Computer Science and Business graduates, who

⁴⁹ If a field of study is removed from the field of study analysis, that group of graduates is also removed from the credential-level analysis to avoid residual disclosure issues.

Figure 5: Average Earnings of College-Level Certificates by Field of Study

LEGEND

- EDUC - EDUCATION
- ARTS - VISUAL AND PERFORMING ARTS, AND COMMUNICATIONS TECHNOLOGIES
- HUM - HUMANITIES
- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- BUS - BUSINESS, MANAGEMENT AND PUBLIC ADMINISTRATION
- MATH - MATHEMATICS, COMPUTER AND INFORMATION SCIENCES
- ENGR - ARCHITECTURE, ENGINEERING, AND RELATED TECHNOLOGIES
- NATR - AGRICULTURE, NATURAL RESOURCES AND CONSERVATION
- HLTH - HEALTH AND RELATED FIELDS
- PPTS - PERSONAL, PROTECTIVE AND TRANSPORTATION SERVICES



earn \$51,600 and \$48,800, respectively. Personal & Protective Services and Natural Resources graduates earn approximately \$45,800, followed by Health (\$40,100) and Social Sciences (\$38,700). Education and Arts graduates both earn approximately \$36,700, and Humanities graduates earn \$33,400 five years after graduating.

Although Humanities and Arts graduates have the lowest earnings levels in all years, they have the highest growth rates from the first to

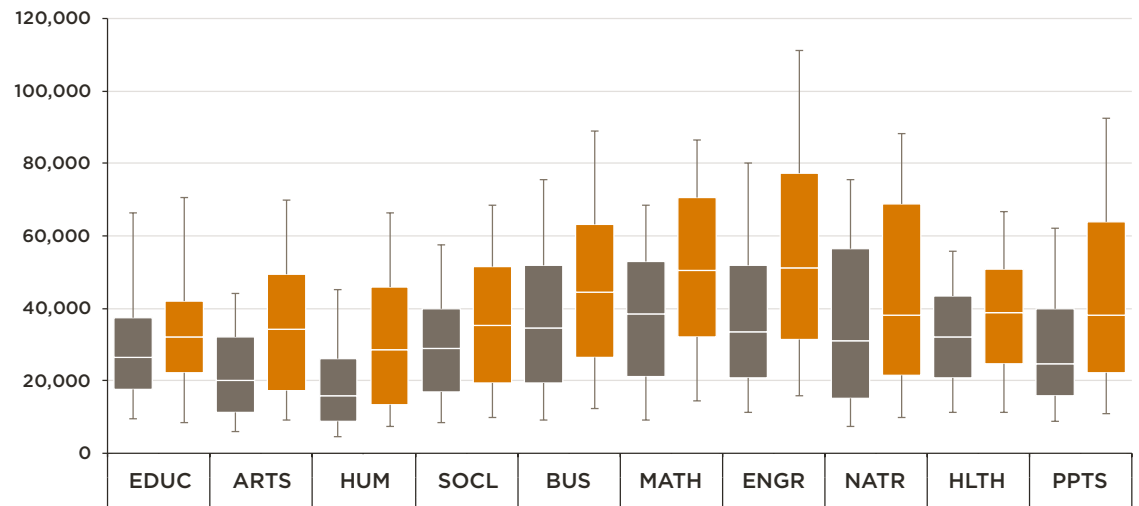
the fifth year, with total increases in earnings of 58% and 57%, respectively, corresponding to 12.2% and 11.9% annual growth rates. Personal & Protective Services and Engineering graduates have similar earnings growth, with 48% and 47% respectively, corresponding to 10.3% and 10.1% annual increases. Math & Computer Science and Business graduates have earnings growth of 33% (7.4%) and 25% (5.8%).

Graduates with certificates in Natural Resources and the Social Sciences have similar earnings growth, approximately

Figure 6: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for College-Level Certificate Graduates by Field of Study

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION



22% (5% annually). Health and Education graduates have earnings growth of 17% (4.1%) and 14% (3.2%), the lowest growth rates, reflected in their having the flattest earnings trajectories. These earnings and their growth rates can be explored in detail on our [interactive dashboard](#).

For all fields of study, the differences in earnings between the top and bottom earners (as captured by the 10th and 90th percentiles) are quite substantial in both the first and fifth years, as seen in [Figure 6](#). While the earnings distributions widen in absolute terms (i.e., in dollar values) for all fields of study, they remain fairly stable in relative terms (i.e., the ratio of earnings at the 90th to the 10th percentile). Earnings growth rates are, therefore, similar for graduates at the higher and lower ends of the earnings distribution.

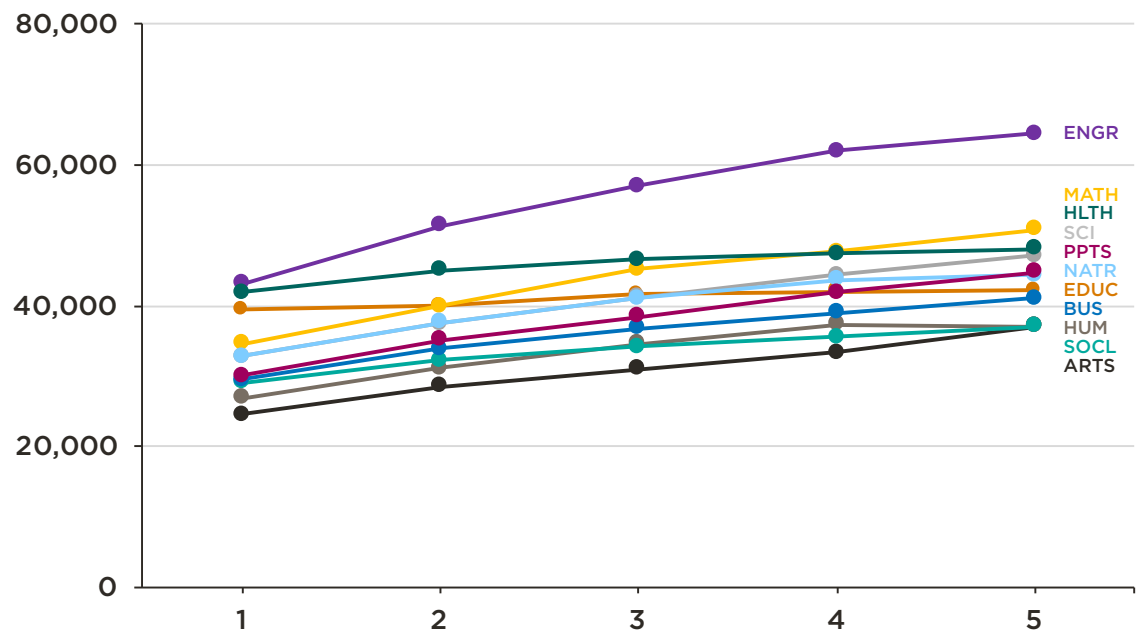
Engineering, Business, Natural Resources, Math & Computer Science, and Personal & Protective Services graduates have greater differences between their lowest (10th percentile) and highest (90th percentile) earners than graduates in the Humanities, Social Sciences, Health, Education, and the Arts.

As with the patterns across credentials, the distributions of earnings across fields of study among college-level certificate graduates overlap to a substantial degree, which means that substantial numbers of graduates from fields with lower average earnings earn more than graduates from fields with relatively higher average earnings, and vice versa. This again illustrates the importance of looking beyond average or median earnings. Interquartile earnings differences (reflecting earnings at the 25th and

Figure 7: Average Earnings of College-Level Diploma Graduates by Field of Study (2016 Constant \$)

LEGEND

- EDUC - EDUCATION
- ARTS - VISUAL AND PERFORMING ARTS, AND COMMUNICATIONS TECHNOLOGIES
- HUM - HUMANITIES
- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- BUS - BUSINESS, MANAGEMENT AND PUBLIC ADMINISTRATION
- SCI - PHYSICAL AND LIFE SCIENCES AND TECHNOLOGIES
- MATH - MATHEMATICS, COMPUTER AND INFORMATION SCIENCES
- ENGR - ARCHITECTURE, ENGINEERING, AND RELATED TECHNOLOGIES
- NATR - AGRICULTURE, NATURAL RESOURCES AND CONSERVATION
- HLTH - HEALTH AND RELATED FIELDS
- PPTS - PERSONAL, PROTECTIVE AND TRANSPORTATION SERVICES



75th percentiles) are also presented in [Figure 6](#) (along with medians). These again point to the substantial differences in earnings across graduates from the same field of study (which again grow over time in almost every case) along with the overlaps across fields of study.

COLLEGE-LEVEL DIPLOMAS

Overall, college-level diploma graduates earn an average of \$34,600

one year following graduation, which increases to \$46,800 in the fifth year. This translates into growth of 35% over the entire period covered, or 7.8% annually. When looking at the results by field of study, [Figure 7](#) shows that in the first year following graduation, Engineering graduates are (as at the college certificate level) the highest earners, and Health and Education graduates also have earnings levels above the credential average, while

the other eight fields of study have earnings below the average.

Five years out, the order of fields of study changes slightly. Engineering, Math & Computer Science, Health, and Science graduates all have earnings above the credential average. Specifically, Engineering graduates earn the most (\$64,500), followed by Math & Computer Science (\$50,800). Health and Science graduates have similar earnings levels (\$48,100 and \$47,100), followed by graduates in Personal & Protective Services and Natural Resources, who also have similar earnings levels (\$44,800 and \$44,300). Education and Business graduates earn just above \$40,000 five years after graduation (\$42,200 and \$41,000) and Social Science, the Arts, and Humanities graduates all earn approximately \$37,000.

In contrast to the results seen in the credential level section where certificate graduates earn more than diploma graduates overall, the latter have higher earnings than the former within most specific fields, and essentially the same earnings in Natural Resources and Math & Computer Science. The exception is Business graduates, among whom college-level certificate graduates earn more than diploma holders (\$48,800 versus \$41,000).

Education, Health, and Social Science graduates are the only fields of study with earnings growth below the credential average, particularly Education and Health graduates, whose earnings trajectories are comparatively flat over the observed period. In dollar terms, most fields of study have similar increases in

earnings (that is, the lines tracing earnings trajectories are relatively parallel), except for Engineering where the increase is greater and Health, Education, and Social Sciences where the increases are smaller.

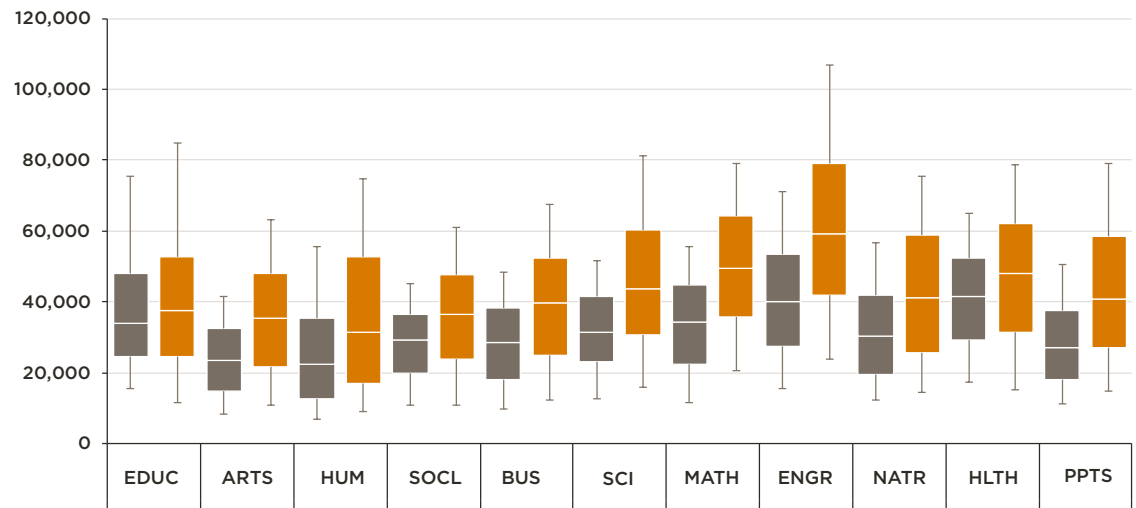
In terms of growth rates, Arts, Engineering, and Personal & Protective Services graduates each experience earnings growth of approximately 50% (between 10.5 and 10.9% per year) during the five years observed. Math & Computer Science and Science graduates also experience substantial earnings growth, at 47% and 44%, representing annual growth rates of 10.2% and 9.6%. Graduates with a diploma in Business, the Humanities, or Natural Resources all experience earnings growth between 35% and 39%, corresponding to annual earnings growth of approximately 8%. Social Science graduates have earnings growth of 28% (6.4%) over the five years, and Health and Education graduates have the lowest growth rates, at 15% and 7%, which translate into annual growth of 3.6% and 1.7%, respectively.

The earnings differences between the top and bottom earners, as captured by the earnings levels at the 10th and 90th percentiles (interquartile ranges are again also shown) are quite substantial. As shown in [Figure 8](#), the differences are evident in both the first and fifth years for all fields of study but are greater for graduates in Education, Engineering, the Humanities, Health, and Science than the other fields. The earnings distributions widen over time in absolute terms, but remain fairly stable in relative terms, again pointing to similar earnings growth rates at the two ends of the earnings distribution.

Figure 8: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for College-Level Diploma Graduates by Field of Study (2016 Constant \$)

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION



Compared to college-level certificates, diploma graduates have narrower earnings distributions in all fields of study in all years, with the exception of Education, the Humanities, and Health.

BACHELOR'S DEGREES

The average earnings of bachelor's degree graduates in the first year following graduation are \$41,100, reaching \$58,700 in the fifth year, representing an annual growth rate of 9.3% (43% in total). Across fields of study, Health and Engineering graduates have the highest earnings in the first year, and Math & Computer Science and Business graduates earn above the average, while graduates in Natural Resources, Education, Sciences, Social Sciences, Humanities, and the Arts have earnings below the credential average (see [Figure 9](#)). Note that the Personal & Protective Services field of study is not available for this

credential due to the small sample size.

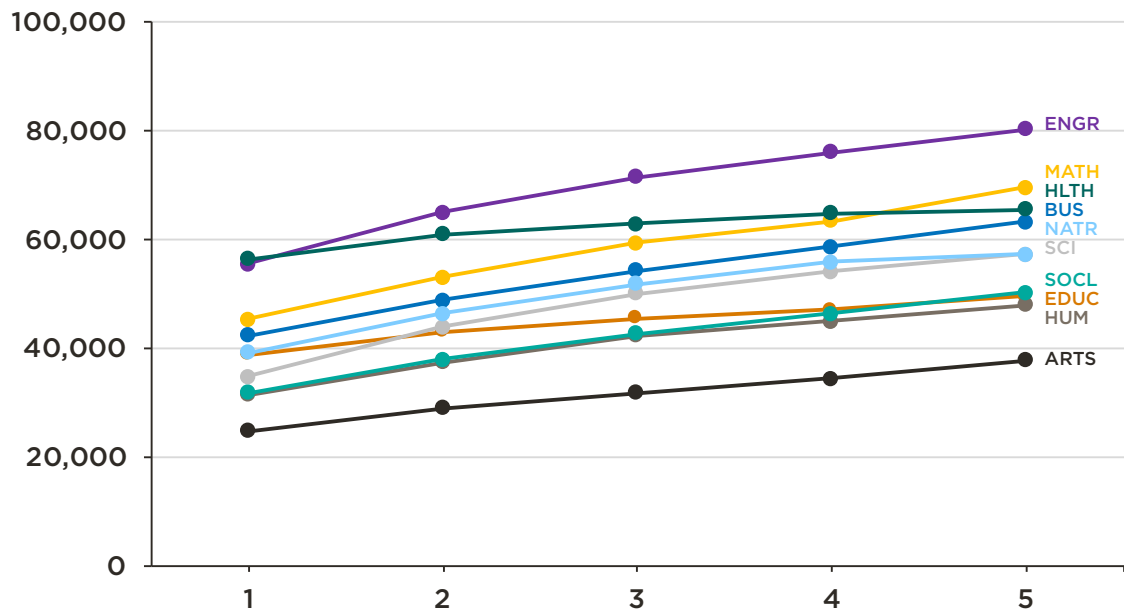
In the fifth year, this general pattern holds, but the specific ordering across fields of study changes for Health and Education. As with the college-level credentials, Engineering graduates earn by far the most at \$80,400. Math & Computer Science graduates follow with earnings levels of \$69,600. Health and Business graduates earn \$65,600 and \$63,300 respectively, and Natural Resources and Sciences both reach approximately \$57,000. Social Science (\$50,300), Education (\$49,600), and Humanities (\$48,000) graduates come next, while Arts graduates earn \$37,800.

With the exception of Education and Health graduates, earnings growth rates are high and relatively similar across most fields of study. The greatest growth is among Science graduates, with 65% in total or 13.3% per year. Social Science (58%), Math & Computer

Figure 9: Average Earnings of Bachelor’s Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- EDUC - EDUCATION
- ARTS - VISUAL AND PERFORMING ARTS, AND COMMUNICATIONS TECHNOLOGIES
- HUM - HUMANITIES
- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- BUS - BUSINESS, MANAGEMENT AND PUBLIC ADMINISTRATION
- SCI - PHYSICAL AND LIFE SCIENCES AND TECHNOLOGIES
- MATH - MATHEMATICS, COMPUTER AND INFORMATION SCIENCES
- ENGR - ARCHITECTURE, ENGINEERING, AND RELATED TECHNOLOGIES
- NATR - AGRICULTURE, NATURAL RESOURCES AND CONSERVATION
- HLTH - HEALTH AND RELATED FIELDS



Science (53%), the Arts (52%), Humanities (52%), and Business (50%) graduates all enjoy earnings increases of at least 50%, with annual average growth rates between 10.6% and 12.1%. Natural Resources and Engineering graduates increase their earnings by 46% (10.0%) and 45% (9.7%), respectively, while Education and Health have the lowest earnings growth over the first five years in the labour market, with 28% and 16%, translating into annual growth rates of 6.3% and 3.8%.

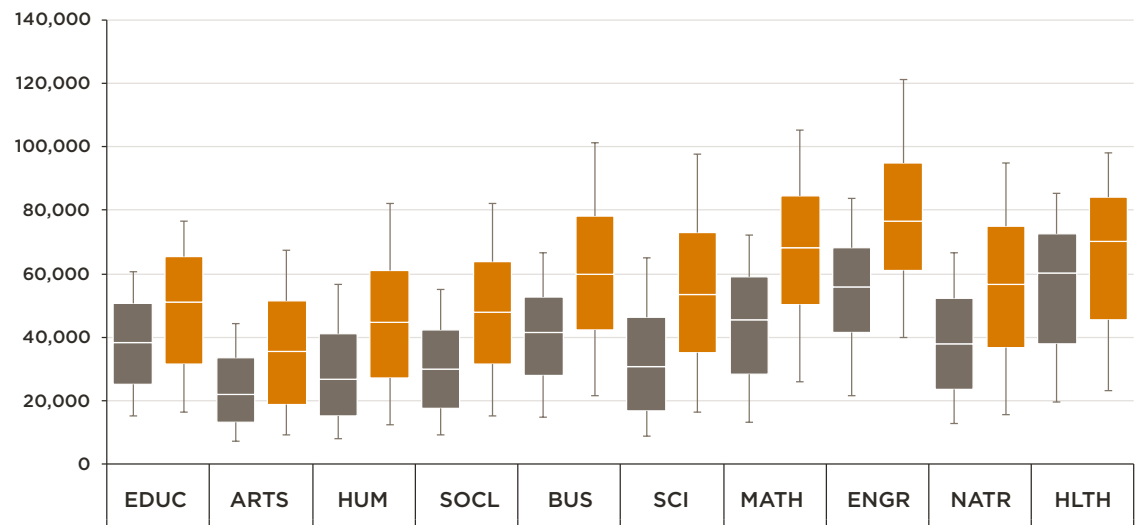
Growth rates are, therefore, relatively similar across most fields of study, with the Education and Health groups being the exception. The same is true for growth in dollar terms. Because of this, the general ordering of the fields in terms of earnings levels is similar over the period covered.

Figure 10 presents the distributions of earnings of bachelor’s degree graduates. These are again wide for all fields of study, but relatively wider

Figure 10: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Bachelor’s Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION



for Engineering, Science, Health, Business, and Math & Computer Science graduates than other fields of study. The distributions widen over time, mostly driven by the relatively greater increases of higher earners within each field, thus pulling further away from those at lower levels.

MASTER’S DEGREES

At the credential level, master’s degree graduates earn an average of \$65,200 in the first year following graduation, which increases by 27% over the observed period (corresponding to a 6.2% annual growth rate), to reach \$83,000 five years out (see [Figure 11](#)). As with bachelor’s degrees, the Personal & Protective Services field of study is not available at the master’s degree level.

As mentioned, Business graduates are by far the top earners and, because they comprise nearly one-third of

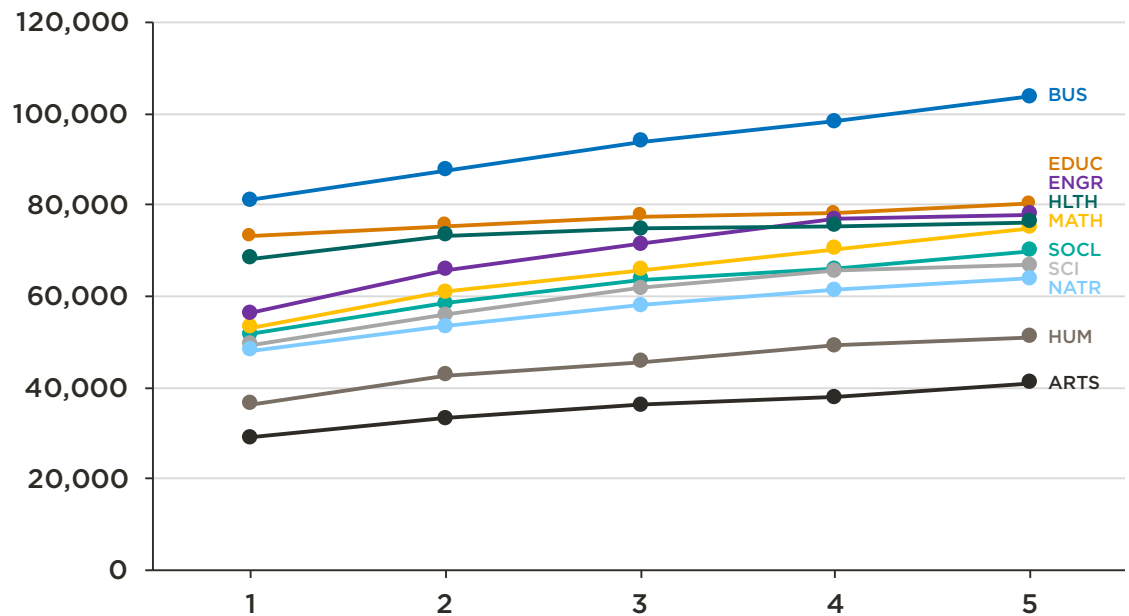
master’s graduates, substantially pull up the overall average earnings for master’s degree graduates. Indeed, Business graduates, at \$103,800, are in fact the only field of study with earnings above the credential average five years after graduation. The next highest earners are those in Education, who earn \$80,300, or \$2,700 less than the credential average.

The specific ordering of fields of study based on first- and fifth-year earnings is the same, the one exception being Health, which slides down the ranking by one spot. Engineering graduates at \$78,000 closely follow Education graduates (the difference is not statistically significant). Note that this is the first instance so far where Engineering graduates are not the top earners five years out. Health (\$76,200) and Math & Computer Science graduates (\$75,100) have similar

Figure 11: Average Earnings of Master's Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- EDUC - EDUCATION
- ARTS - VISUAL AND PERFORMING ARTS, AND COMMUNICATIONS TECHNOLOGIES
- HUM - HUMANITIES
- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- BUS - BUSINESS, MANAGEMENT AND PUBLIC ADMINISTRATION
- SCI - PHYSICAL AND LIFE SCIENCES AND TECHNOLOGIES
- MATH - MATHEMATICS, COMPUTER AND INFORMATION SCIENCES
- ENGR - ARCHITECTURE, ENGINEERING, AND RELATED TECHNOLOGIES
- NATR - AGRICULTURE, NATURAL RESOURCES AND CONSERVATION
- HLTH - HEALTH AND RELATED FIELDS



earnings levels, and Social Science graduates earn \$70,000. Graduates in the Sciences and Natural Resources follow, with earnings levels of \$66,900 and \$63,900. Humanities graduates earn \$51,200 five years out and Arts graduates have earnings levels of \$41,000.

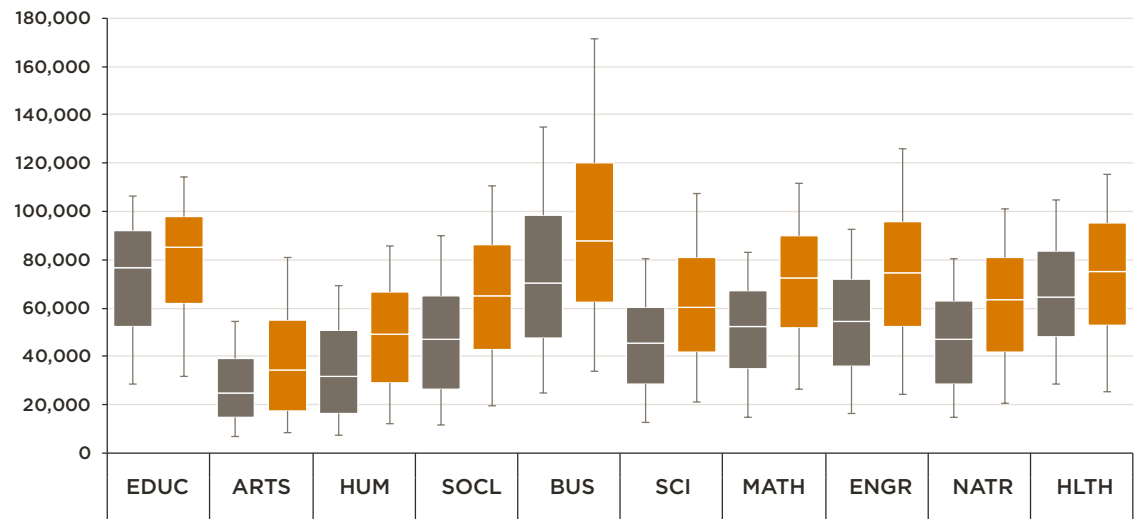
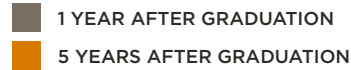
Only Health and Education graduates have earnings growth below the credential average, yet Education graduates still have the second highest

earnings levels in all years due to their high starting level; Health graduates come fourth five years out.

Earnings growth rates tend to be more modest for master's degree graduates than the other credentials. Math & Computer Science and Arts graduates both have earnings growth of 41% over the first five years following graduation (or approximately 9% per year). Engineering graduates follow closely, with earnings growth of 38%

Figure 12: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Master's Degree Graduates by Field of Study (2016 Constant \$)

LEGEND



(8.4%), and then Social Science and Science graduates, with growth of 35% (7.9% and 7.8%). Natural Resources and Business graduates' earnings grow by 33% (7.4%) and 28% (6.4%), while Health and Education graduates have more modest earnings growth of 11% (2.7%) and 10% (2.4%).

The distributions of earnings of master's degree graduates are much wider than the other credentials seen so far (Figure 12). The widest distribution is for Business graduates, who have a \$109,800 difference between the 90th and 10th earnings percentiles in the first year following graduation, almost double that of bachelor's degree graduates in Business. While the absolute dollar differences separating the top and bottom earners increase from the first to the fifth year, the relative earnings differences are stable, thus pointing to relatively similar growth

rates in earnings at the top of the earnings distribution and the bottom.

DOCTORAL DEGREES

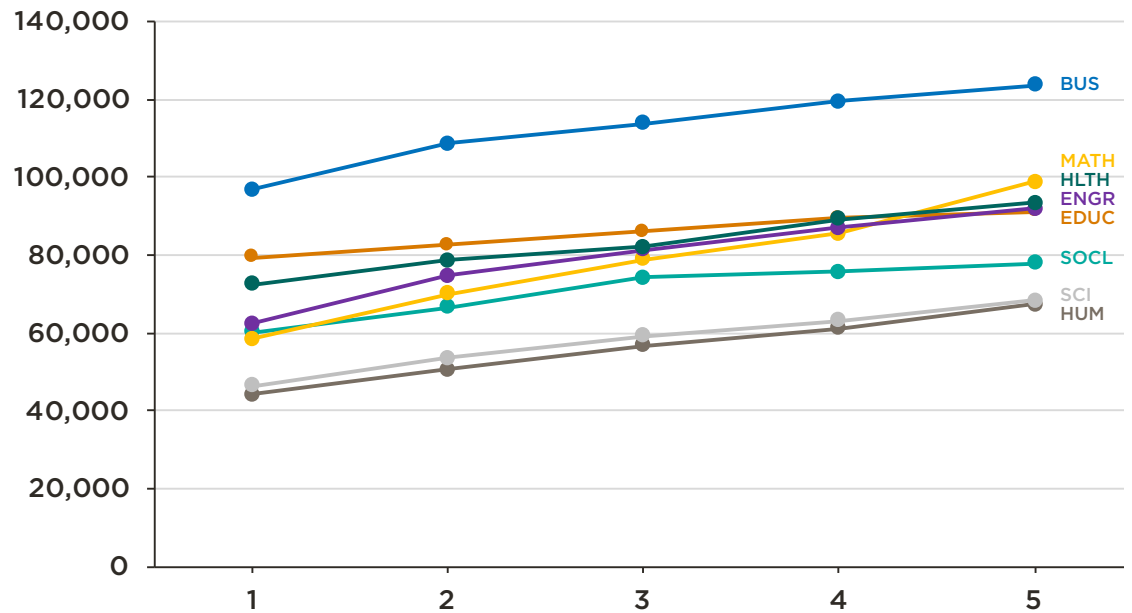
Doctoral degree graduates in all fields earn, on average, \$60,100 in the first year following graduation and \$82,800 in the fifth year, representing an increase of 38%, or an 8.3% annual growth rate (Figure 13). Due to the relatively small number of doctoral students, only eight fields of study are available for this credential — the Arts, Natural Resources, and Personal & Protective Services are not available.

As with master's degree holders, doctoral graduates in Business have by far the highest earnings in every year. However, as they represent the smallest group of graduates (4% among doctoral degree holders), their outsized earnings have a much smaller effect on the credential's overall average

Figure 13: Average Earnings of Doctoral Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- EDUC - EDUCATION
- HUM - HUMANITIES
- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- BUS - BUSINESS, MANAGEMENT AND PUBLIC ADMINISTRATION
- SCI - PHYSICAL AND LIFE SCIENCES AND TECHNOLOGIES
- MATH - MATHEMATICS, COMPUTER AND INFORMATION SCIENCES
- ENGR - ARCHITECTURE, ENGINEERING, AND RELATED TECHNOLOGIES
- HLTH - HEALTH AND RELATED FIELDS



earnings — thus further pointing to the role of master’s level Business graduates in driving the overall master’s-doctoral mean earnings patterns. As a result, and in contrast to what is seen in the credential section (Figure 2), comparing earnings for each field of study across the two credential levels shows that doctoral graduates earn more than master’s graduates in every field of study.

Along with Business, graduates from Math & Computer Science, Education, Health, and Engineering fields also have

earnings levels above the credential average five years out. Business graduates earn \$123,600 five years after graduating, but Math & Computer Science graduates have the second highest earnings at \$98,700. Health (\$93,300), Engineering (\$92,000), and Education (\$91,200) graduates all earn above \$90,000. Social Science graduates earn more than those who studied Science (\$77,900 versus \$68,300 five years after graduation). Humanities graduates still have lower earnings than others do, but at \$67,300,

they earn only \$1,000 less than Science graduates.

In terms of earnings growth, doctoral degree graduates have stronger growth rates than master's graduates and are comparable to those of other credentials. Math & Computer Science graduates have the greatest growth in earnings, with 69% or a 14.0% annual growth rate. With total growth rates between 52% and 47%, Humanities (11.1% per year), Engineering (10.2% per year), and Science graduates (10.1% per year) also have above average earnings growth.

Graduates in the Social Sciences and Health also have similar earnings growth 29% (approximately 6.5%), followed by Business graduates, whose earnings increase by 28% (6.3%). Education graduates again have the lowest growth rate at 15%, or 3.6% per year.

Again, in every field, doctoral degree graduates earn more than do master's degree graduates. In both cases, graduates from Business fields earn by far the most in all years compared to other fields of study.

In terms of distribution of earnings, in the first year following graduation the differences separating the 90th and 10th percentiles of doctoral degree graduates in Business, Health, and Education are all greater than \$100,000, while Humanities and Science graduates have the smallest earnings differences. Five years out, five fields of study now have differences of over \$110,000 between the 90th and 10th percentiles: Math & Computer Science, Education, Engineering, Health, and Business (see [Figure 14](#)).

While the dollar values of these earnings differentials increase over time, the relative differences between the top and bottom earners narrow in relative terms, indicating greater relative earnings growth among low earners than among high earners. Doctoral degree graduates are the only credential group in which all fields of study see their earnings distribution narrow in relative terms over time. Furthermore, doctoral degree graduates in Business are the only ones who also experience a decrease in the absolute difference of earnings between the 90th and 10th percentiles, falling from \$130,400 to \$111,500 in year one and year five.

PROFESSIONAL DEGREES

There are only two fields of study for professional degree graduates, Health (including doctors and others) and Social Sciences (principally capturing lawyers). Taken together, these fields earn, on average, \$68,300 in the first year following graduation and \$99,600 in the fifth year, an increase of 46% or an annual growth rate of 9.9% (see [Figure 15](#)).

While Health graduates (\$81,100) earn substantially more than Social Science graduates (\$52,200) in the first year following graduation, in the fifth year they have effectively equal earnings levels (Social Sciences, \$99,900 and Health \$99,200). This rapid narrowing of the earnings differential between these two fields of study is driven by the high earnings growth rate for professional degree holders in the Social Sciences — 91% or 17.6% per year — which, by a wide margin, is the greatest earnings growth observed among all fields at all credential levels.

Figure 14: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Doctoral Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION

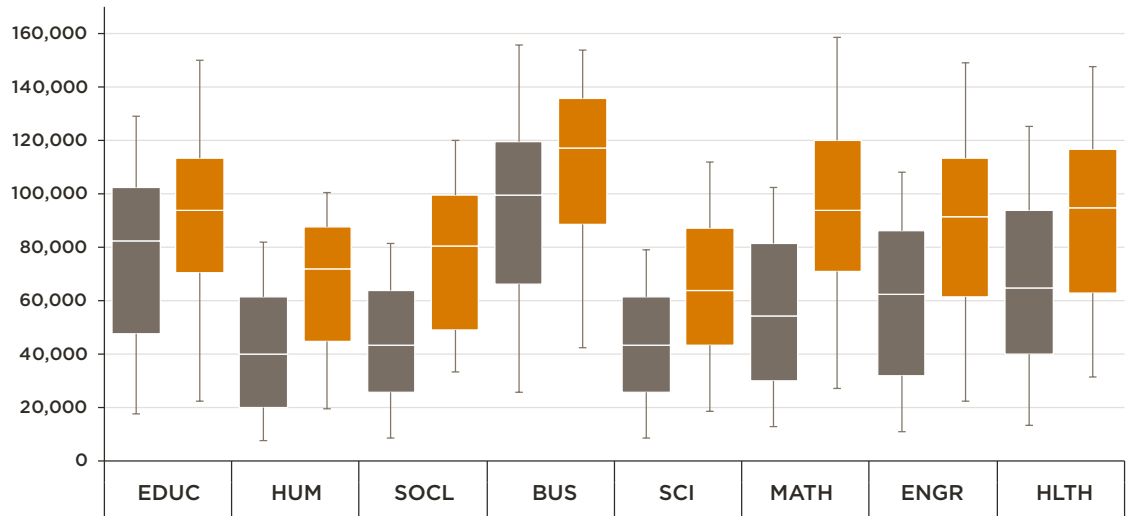


Figure 15: Average Earnings of Professional Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- SOCL - SOCIAL AND BEHAVIOURAL SCIENCES AND LAW
- HLTH - HEALTH AND RELATED FIELDS

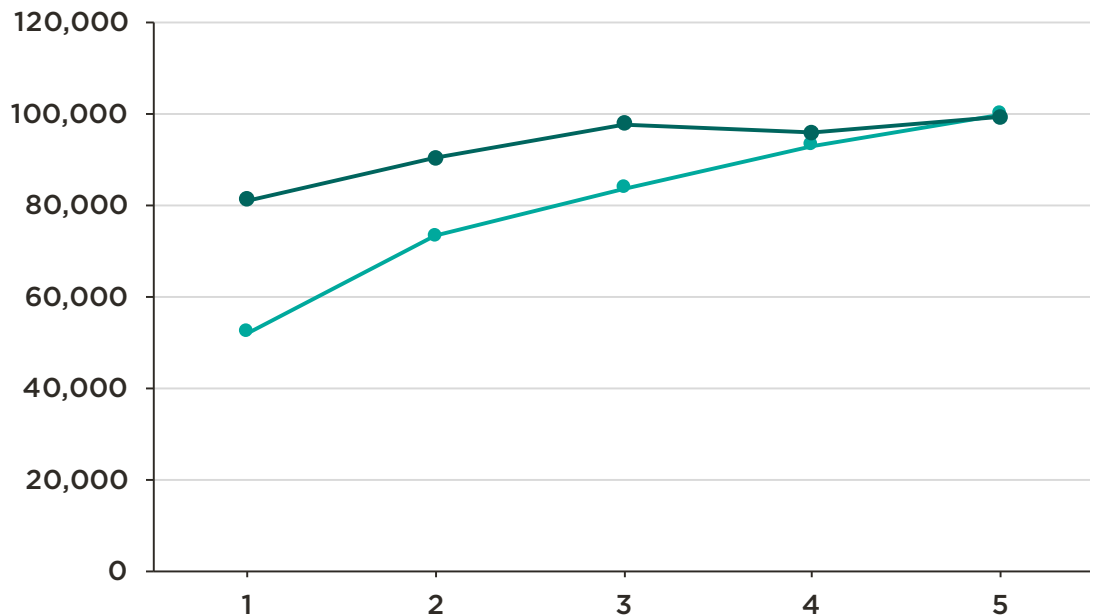
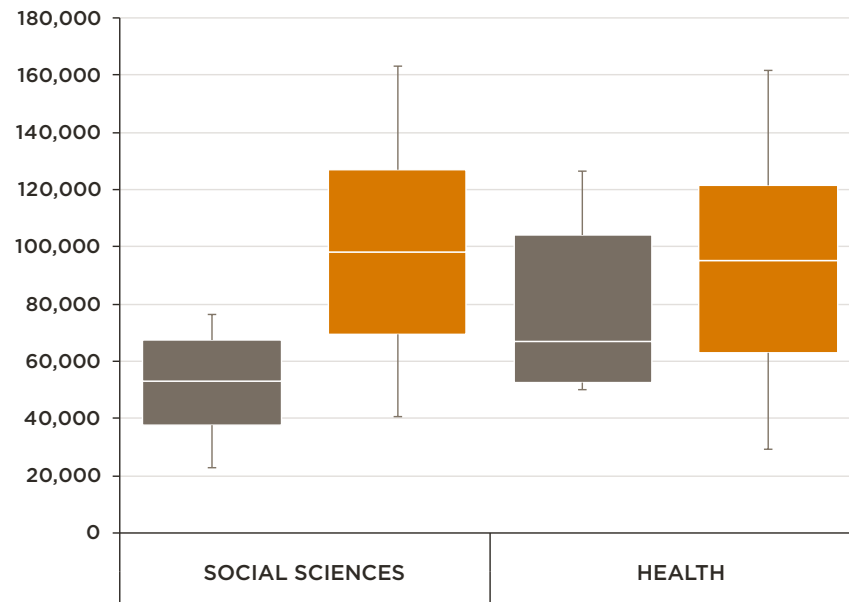


Figure 16: Selected Earnings Percentiles (10th, 25th, 50th, 75th, and 90th) for Professional Degree Graduates by Field of Study (2016 Constant \$)

LEGEND

- 1 YEAR AFTER GRADUATION
- 5 YEARS AFTER GRADUATION



The earnings growth rate for Health graduates with professional credentials is, at 22% (5.2% per year), far lower than for Social Science graduates at 91% (17.6% per year). Furthermore, almost all the earnings growth for Health graduates occurs by the third year after graduation and is essentially flat thereafter. This pattern is cause for some scepticism. As noted above, professional degree graduates' earnings may not be captured as accurately as other groups because they may be more likely to incorporate dividends and other corporate income are not available on the ELMLP. In particular, such income sources are likely important for doctors, dentists, pharmacists, and other professional degree holders in Health fields.⁵⁰

The earnings trajectories for this group should, therefore, be interpreted with this caveat in mind.

As with their average earnings levels, the two groups of professional degree graduates have rather different earnings distributions one year after graduation (see [Figure 16](#)). The figures show a wider distribution for Health graduates in year one, which then becomes very similar five years out. For Health graduates, the 10th percentile decreases substantially from the first to fifth year following graduation. Again, this may reflect the idiosyncrasies of earnings sources for this specific group of graduates as well as how earnings are measured here.

⁵⁰ See sections 3.2, 3.5, and 4.1.

Earnings by Credential within each Field of Study

Finally, we compare the earnings levels within each field of study by credential in [Figure 17](#). By pulling together the findings seen above in a more concise format, it becomes clear that for each field of study, earnings are generally ordered by the total number of years of study typically required to obtain the credential. Specifically, doctoral degree graduates earn more than those with master's degrees, who in turn earn more than bachelor's degree holders within each field of study. Graduates with college-level diplomas and certificates then follow these credentials. In the two fields that include professional degrees, Health and Social Science, these graduates have the highest earnings in each year (except for Social Science in the first year).

Secondly, within those broad orderings, the distances across the different credential levels vary considerably by field of study. Education, Social Science, Business, and Health graduates generally have wider differences in earnings across credentials, whereas the differences are more moderate in the Humanities, Sciences, Natural Resources, Math & Computer Science, and Engineering. The distances between credential earning levels are the smallest in the Arts and Personal & Protective Services with the latter including only college-level certificates and diplomas.

4.2 A Gender Perspective

This subsection examines the earnings patterns by credential, and then by field of study within credentials, for men and women. In terms of the gender distribution of graduates in our sample, women account for a majority within each credential, except at the doctoral level ([Table 7](#), "Overall" row). While the share of female graduates by field of study varies widely, women nevertheless account for the majority of students in most cases. Notable exceptions are Engineering and Math & Computer Science where women are substantially underrepresented.⁵¹

Earnings Differences between Women & Men by Credential

In comparing the earnings of female and male graduates for each credential, the differentials represent how much less women earn relative to men. Specifically, we calculate $\left(\frac{E_F - E_M}{E_M}\right)$ expressed in percentage terms, where E_M and E_F represent the average earnings of men and women respectively.

[Figure 18](#) indicates that in every instance female graduates have lower average earnings than their male counterparts. For most credentials, there is already a sizable difference in earnings between men and women in the first year after graduation. Women with college-level certificates and women with master's degrees earn, respectively, 21.1% (\$8,600) and 17.6% (\$12,800) less than their male counterparts. For college-level diploma, doctoral, bachelor's, and

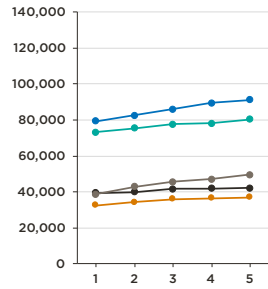
⁵¹ The distribution of graduates across credentials is very similar for both genders (results not shown), with bachelor's graduates comprising roughly half of all graduates (50%) and college-level diplomas approximately a quarter (25%). College-level certificates and master's degrees each represent roughly 10% of graduates for both genders. Finally, doctoral and professional degrees have the smallest shares of graduates for both genders, with approximately 2.5% of graduates in each case.

Figure 17: Average Earnings by Credential within Each Field of Study (2016 Constant \$)

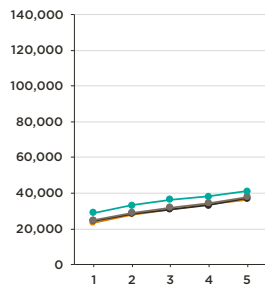
LEGEND

- COLLEGE-LEVEL CERTIFICATE
- COLLEGE-LEVEL DIPLOMA
- BACHELOR'S DEGREE
- MASTER'S DEGREE
- DOCTORAL DEGREE
- PROFESSIONAL DEGREE

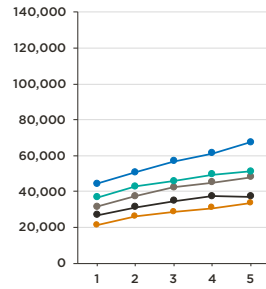
Education



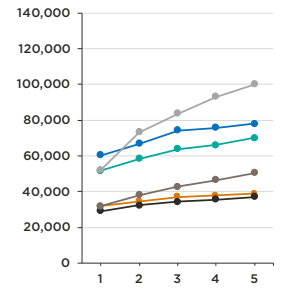
Arts



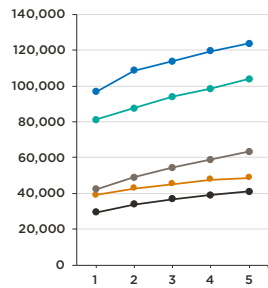
Humanities



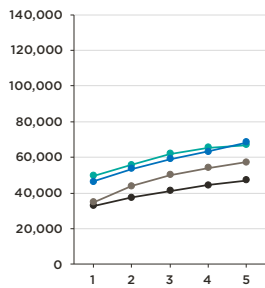
Social Sciences



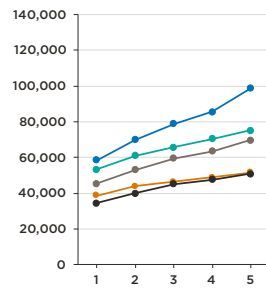
Business



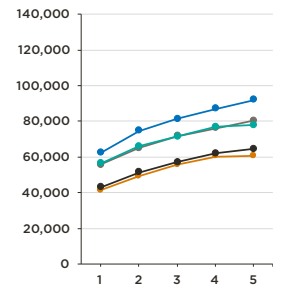
Science



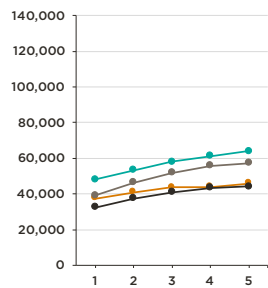
Math & Computer Science



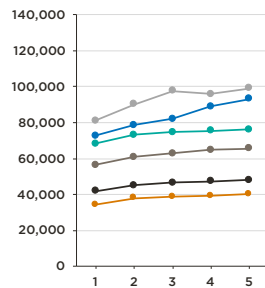
Engineering



Natural Resources



Health



Personal & Protective Services

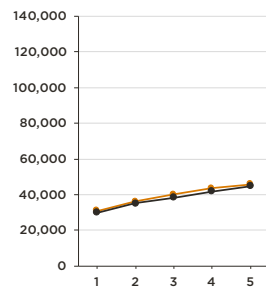
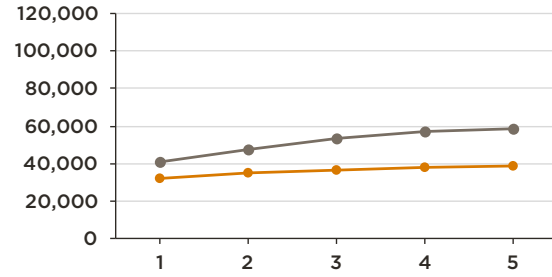


Figure 18: Average Earnings of Female and Male Graduates by Credential (2016 Constant \$)

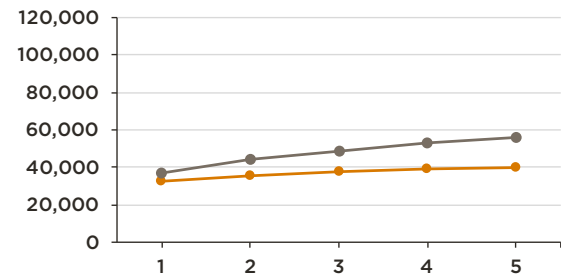
LEGEND

- FEMALE
- MALE

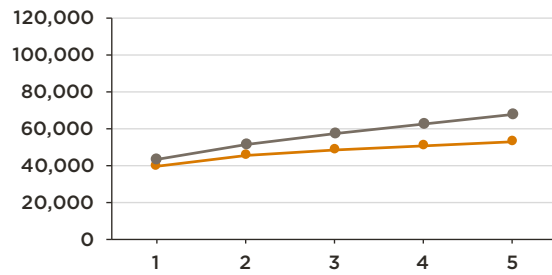
College-level Certificate



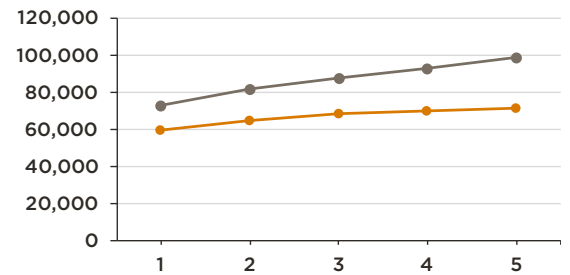
College-level Diploma



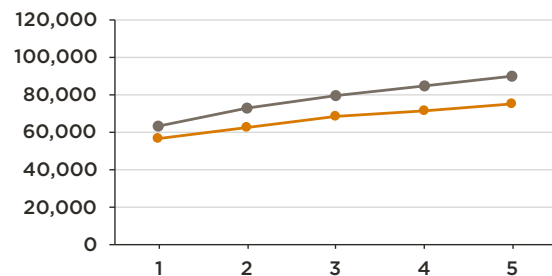
Bachelor's Degree



Master's Degree



Doctoral Degree



Professional Degree

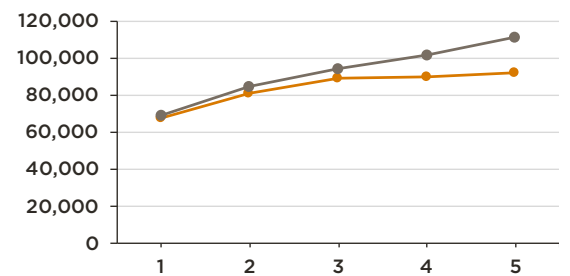


Table 7: Share of Female Graduates (%) by Credential and Field of Study, One Year after Graduation⁵²

	College-Level Certificate	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree	Professional Degree
Education	87.4	81.6	75.3	75.7	64.0	-
Arts	56.2	63.6	64.7	64.3	-	-
Humanities	60.0	59.5	62.1	60.4	54.8	-
Social Sciences	86.6	83.4	65.8	64.7	63.5	55.1
Business	80.4	65.6	54.4	49.1	42.9	-
Sciences	-	53.3	56.5	58.0	45.3	-
Math & Computer Science	34.8	28.5	21.0	46.3	26.1	-
Engineering	8.9	13.3	18.9	29.5	20.3	-
Natural Resources	47.7	42.2	51.3	62.7	-	-
Health	84.3	83.6	84.6	82.2	61.3	63.2
Personal & Protective Services	45.6	39.5	-	-	-	-
OVERALL	55.9	58.3	60.8	58.0	46.6	59.6

professional degree holders, the relative earnings differences between men and women are 12.1%, 10.3%, 7.4%, and 2.0%, respectively, in the first year after graduation.⁵³

For every credential, the difference in average earnings between men and women increases over the five years observed. Five years after graduation, the difference in average earnings between men and women ranges from 33.7% for college-level certificate graduates to 16.0% for doctoral degree graduates. The relative earnings differences for other credentials five years after graduation are as follows: 28.8% for college-level diplomas; 21.7% for bachelor's degrees; 27.5% for master's degrees; and 17.2% for professional degrees.

These findings align with a vast literature that shows women face greater hurdles in the labour market than men do. Disentangling the factors related to these gender differences would require more information. The ELMLP, however, does not currently contain information such as hours and weeks worked (including differences due to child-rearing and other family responsibilities), or differences in occupation choices, not to mention the potential presence of discrimination (see also [Box 2](#)).

Earnings Differences between Women & Men by Field of Study

Examining gender differentials at the credential level, as done above, provides a useful, broad overview of these

⁵² The shares of female graduates at graduation, before any sample restrictions are imposed, are very similar to those reported here, varying by at most 2.5 percentage points in any given case.

⁵³ See the [Appendix](#) for absolute and relative earnings differences by gender.

Box 2. Limitations & Caveats for Gender Earnings Differentials

The ELMLP presents unique opportunities for exploring gender earnings differentials, including its near complete representation of the population of Canadian PSE students (and graduates); its accurate information on credential, field of study, and income; and the opportunity it provides to track students on a year-by-year basis following graduation.

There are, however, several limitations and corresponding caveats associated with using the ELMLP to measure gender earnings differentials, including the lack of information on hours and weeks worked, and schooling and occupational choices.

Hours and weeks of work: Women work, on average, fewer paid hours than men, so accounting for differences in the number of hours/weeks worked during the year could explain some portion of the observed earnings differentials. If, however, hours or weeks worked are partially driven by labour market discrimination or related factors that limit women's choices, controlling for these factors would lead to an underestimation of the differences in labour market opportunities — and rewards — for women and men as represented in gender differentials in annual earnings. These and related issues are the subject of a vast research literature.

Occupation: A similar set of arguments apply to occupation.

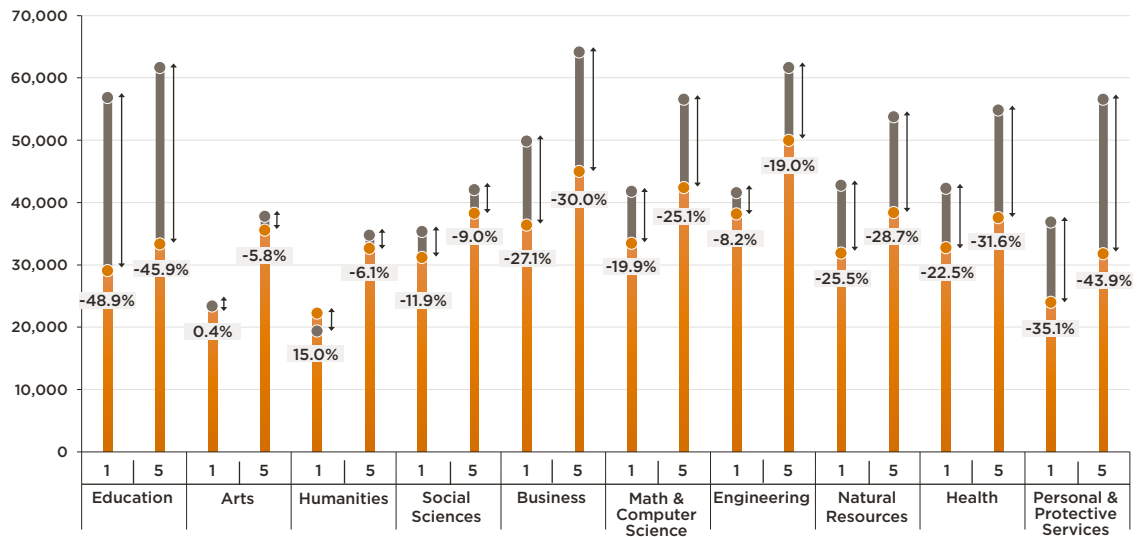
On the one hand, controlling for gender differences in occupation, especially at the detailed level, can help explain gender earnings differentials. But it is appropriate to do so under the assumption that occupation choices are the outcome of gender differences in preferences (e.g., women might voluntarily choose lower-paying but more flexible occupations). Conversely, if occupational differences are related to labour market discrimination that limits women's access to certain occupations, then taking occupation into account would lead to underestimates of the true earnings differentials. This remains a controversial issue in the literature (see Drolet, 2002; Lemieux, 2011; Lemieux, 2014; and Boudarbat & Connolly, 2014, for the Canadian context). Furthermore, some studies suggest that a significant factor in the differences in occupations are driven by differences in field of study (e.g., Lemieux, 2014). Controlling for field of study therefore would indirectly account for a significant part of the gender difference (not driven by labour market discrimination) in occupations.

The forthcoming linkages (planned for 2020) between the 2018 National Graduates Survey (NGS), 2016 long-form Census, and core ELMLP datasets might help address some of these issues with information on occupation and types of employment (LMiC, 2018b; 2019b).

Figure 19: Gender Earnings Differentials of College-Level Certificate Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE



patterns and how they evolve over the early years following graduation, but they also reflect important underlying differences related to field of study. In particular, men and women tend to have different distributions across fields of study, while earnings patterns also vary by field. The overall gender differentials at the credential level reflect both sets of factors.⁵⁴ It is therefore important to look at gender differentials within each field of study, as we do here. For a discussion of the role of field of study and related issues in comparing the earnings of men and women, see [Box 2](#).

COLLEGE-LEVEL CERTIFICATES

The largest relative initial earnings differential is between men and women

with college-level certificates — 21.1% (\$8,600). This difference grows to 33.7% (\$19,700) five years after graduation. To dig deeper into gender earnings differences by field of study, [Figure 19](#) (and all subsequent figures in this section) compares the first and fifth year earnings of men and women for each field of study. The earnings of men and women are vertically aligned, with orange circles indicating women’s earnings and black circles indicating men’s earnings. The percentage difference in earnings, expressed as how much less women earn than men, is also shown.

[Figure 19](#) shows that, with the exceptions of Humanities and the Arts,

⁵⁴ For example, men are much more likely than women to study Engineering, which is also a generally high-earning field of study. Women are relatively more likely to study Arts, Humanities, or Social Sciences, where earnings are generally lower. Gender differentials at the credential level reflect both these sets of differences.

female graduates with a college-level certificate earn substantially less than male graduates in the first year after graduation in each field of study. Over the five years observed, the relative earnings differences narrow only for Education and Social Science graduates. In all other cases, women earn relatively less than their male counterparts five years after graduating than they do in the first year after graduating.

The slight narrowing of the gender earnings differential among Education graduates belies the fact that this field of study has the widest earnings difference in all years for college-level certificate holders. Female Education graduates start by earning about half (48.9%) of what men do (\$29,000 compared to \$56,800), a difference that narrows to 45.9% (\$28,300) five years after graduating.

In the two cases where women start out earning more than men do, the differential reverses over time. In particular, female Humanities graduates earn 15.0% more (\$2,900) than their male counterparts in the first year following graduation, but slip to 6.1% less (\$2,100) four years later. Similarly, male and female Arts graduates start at comparable earnings levels in the first year after graduation, but here too the earning difference reverses, with women earning 5.8% less than men (\$2,200) five years after graduation.

COLLEGE-LEVEL DIPLOMAS

Overall, women with a college-level diploma earn 12.1% (\$4,500) less than men with this credential in the first year following graduation. This difference grows to 28.8% (\$16,200) four years later.

Figure 20 highlights that, in all fields of study, female graduates with a college-level diploma earn less than their male counterparts in every year, and these earnings differentials increase over time.

Although graduates in the Humanities start with the smallest gender earnings difference among all fields — with women earning 2.2% (\$600) less than men in the first year — the difference increases to 18.8% (\$7,800) after five years.

As with college-level certificate holders, the largest earnings difference is seen among Education graduates with a college-level diploma, where women earn 38.8% (\$22,300) less than men. After five years, the difference remains the highest across all fields, increasing to 43.9% (\$28,600).

BACHELOR'S DEGREES

After professional degree holders, the earnings difference between male and female bachelor's degree graduates is the narrowest among the six credentials analyzed here. Overall, women with a bachelor's degree earn 7.4% (\$3,200) less than men in the first year after graduation, yet this difference grows substantially over time, reaching 21.7% (\$14,600) five years after graduation.

Figure 21 shows that in all fields of study, with the exception of Health, female graduates with bachelor's degrees earn substantially less than their male counterparts in the first year following graduation. Further, the earnings differentials increase over time for all fields of study.

Indeed, even for graduates in Health, where women start by earning 22.6% (\$10,700) more than their male

Figure 20: Gender Earnings Differentials of College-Level Diploma Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE

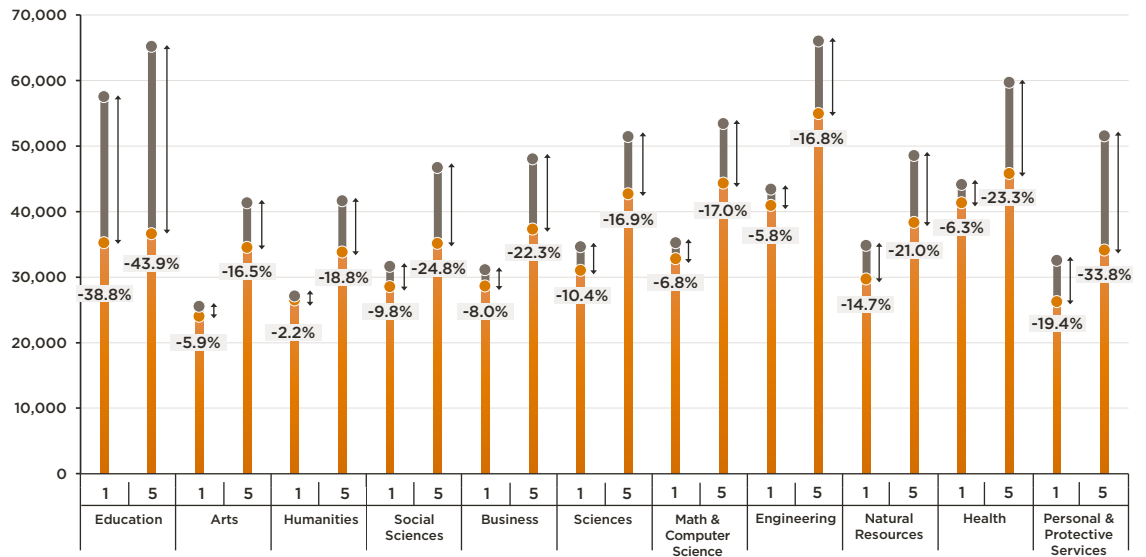


Figure 21: Gender Earnings Differentials of Bachelor's Degree Graduate by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE

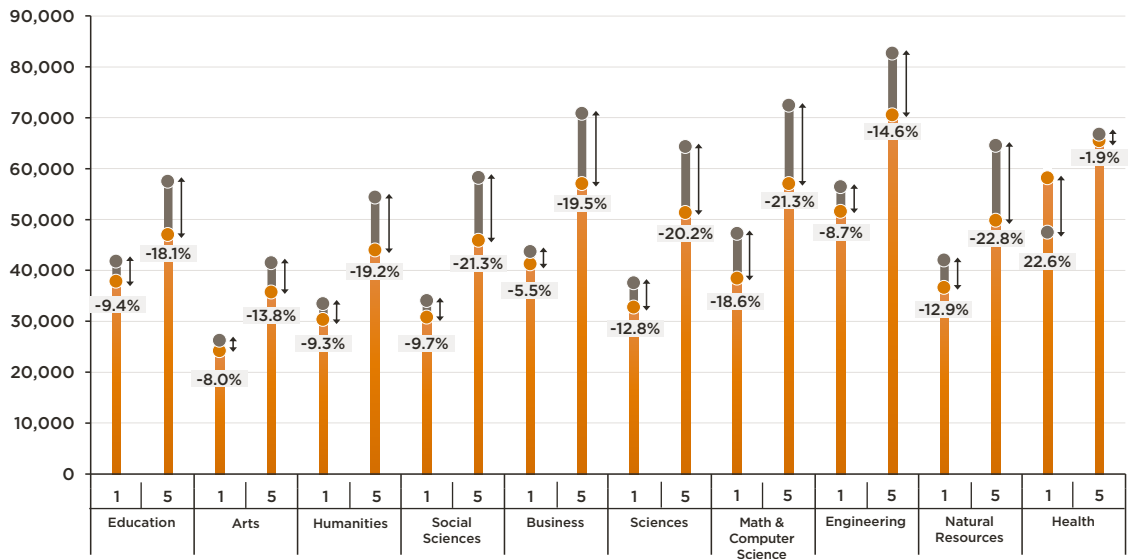
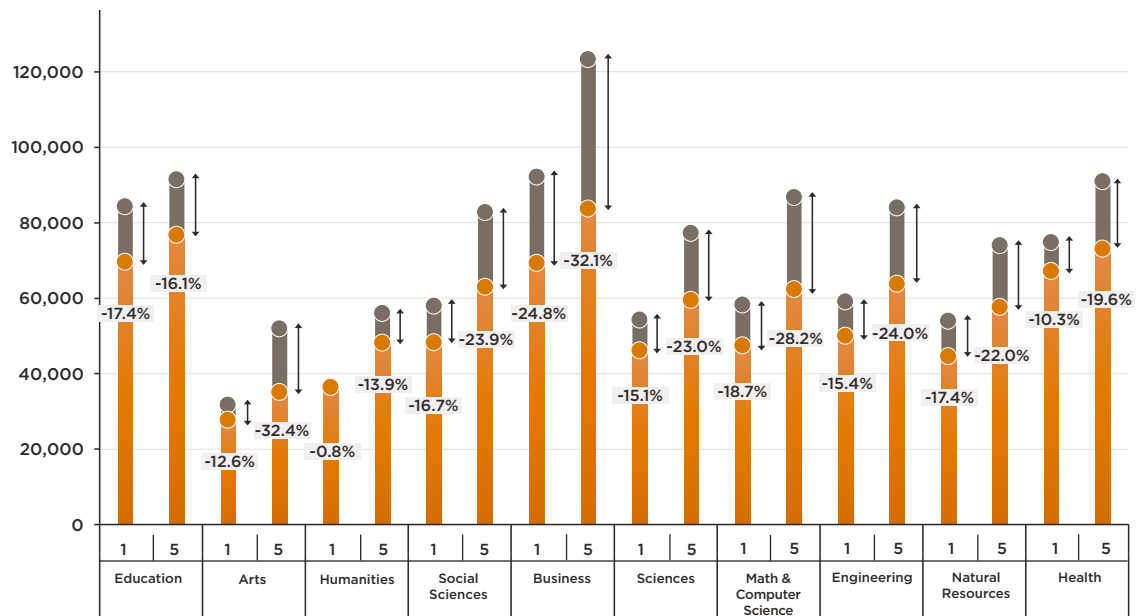


Figure 22: Gender Earnings Differentials of Master's Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE



counterparts, the difference soon reverses. Women earn 1.9% (\$1,300) less five years after graduation.

The greatest earnings difference in the first year is with Math & Computer Science graduates at 18.6% (\$38,400 for women compared to \$47,200 for men). After five years, this difference widens to 21.3% (\$15,400), second only to the differential between men and women with a degree in Natural Resources, which is 22.8% (\$14,700) five years after graduation.

Although graduates in Business start with the smallest gender earnings differentials, with women earning 5.5% (\$2,400) less than men, the difference reaches 19.5% (\$13,800) after five years, representing the greatest increase in percentage point terms.

Female graduates with bachelor's degrees in other fields of study have earnings differentials below 13% in the first year, but these differences also widen over time.

MASTER'S DEGREES

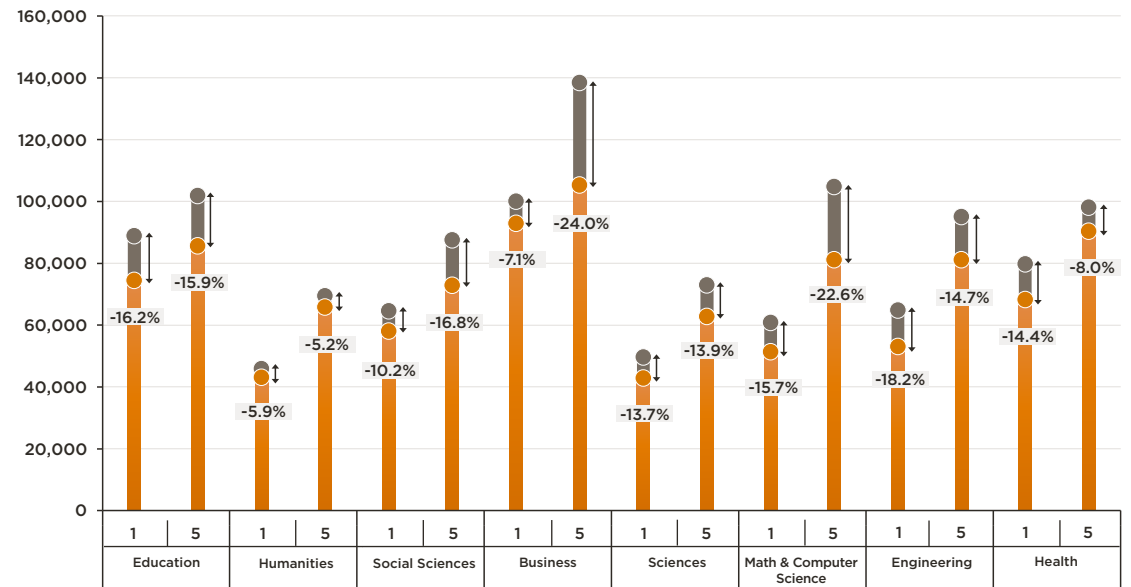
Master's degree holders have the second largest earnings differential at the credential level and the largest in absolute (dollar value) terms. Overall, women with a master's degree earn 17.6% (\$12,800) less than men with the same credential in the first year, a difference that grows to 27.5% (\$27,200) five years out.

In all fields of study, female graduates with a master's degree earn substantially less than males in the first year following graduation (Figure 22). These earnings

Figure 23: Gender Earnings Differentials of Doctoral Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE



differentials increase over time for most fields, with the difference in Education narrowing slightly from 17.4% to 16.1%.

Although graduates in the Humanities start with the smallest gender earnings differential in the first year, with women earning almost the same as men (\$300 or 0.8% less), the difference increases to 13.9% (\$7,800) after five years.

The greatest earnings difference is seen among Business graduates, where women earn 24.8% (\$22,900) in the first year. Five years after graduating, the difference increases, remaining the highest dollar differences with women earning 32.1% (\$39,600) less. The largest percentage difference, however, is observed among Arts graduates: 32.4% (\$16,800).

DOCTORAL DEGREES

Overall, women with a doctoral degree earn 10.3% (\$6,500) less than men with the same credential in the first year after graduation. This difference grows to 16.0% (\$14,300) five years after graduation. As with master’s degree holders, in all fields of study, female doctoral degree holders earn less than their male counterparts in the first and fifth years following graduation, as [Figure 23](#) illustrates.

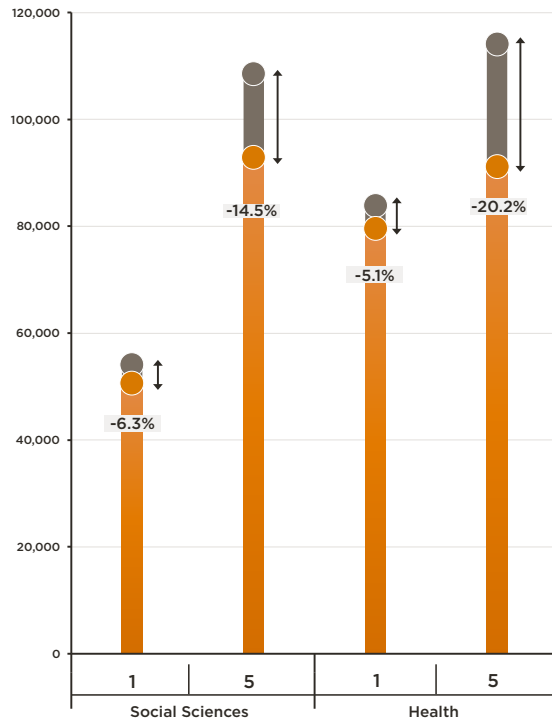
And while the earnings differentials increase over time for Social Science, Math & Computer Science, and Business graduates, they remain stable or decline for Science, Humanities, Health, Education, and Engineering graduates.

The greatest earnings difference in the first year after graduation is

Figure 24: Gender Earnings Differentials of Professional Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- FEMALE
- MALE



seen among Engineering doctoral graduates, where women earn 18.2% less than men (\$11,800), which narrows to 14.7% (\$14,000) five years after graduation. The earnings differential between men and women is also substantial among Math & Computer Science graduates five years after graduation — 22.6% (\$23,700).

Although female Business graduates with doctorates start by earning 7.1% less (\$7,100) than men do, this increases to 24.0% (\$33,200) five years out. This represents both the largest earnings difference in any fields of study as well as the largest growth in the gender earnings difference.

PROFESSIONAL DEGREES

Professional degree holders have the smallest earnings differentials between men and women at the credential level. Overall, women with a professional degree earn 2.0% (\$1,400) less than men, a difference that grows to 17.2% (\$19,100) five years after graduation.

In year one, only small differences in earnings exist between men and women in the two fields of study available for professional degree holders (Health and Social Sciences). However, [Figure 24](#) shows that the differences increase over time for both fields of study.

Table 8: Distribution (%) of Canadian and International Student Graduates by Credential, Before and After Sample Restrictions

PSE Credential	Before Restrictions		After Restrictions		After Restrictions	
			Year 1		Year 5	
	Can.	Int.	Can.	Int.	Can.	Int.
College-level Certificate	97.2	2.8	98.4	1.6	98.6	1.4
College-level Diploma	92.8	7.2	94.2	5.8	95.1	4.9
Bachelor's Degree	93.4	6.6	96.0	4.0	96.7	3.3
Master's Degree	84.2	15.8	92.1	7.9	92.9	7.1
Doctoral Degree	86.2	13.8	92.1	7.9	93.1	6.9
All Credentials	92.5	7.5	95.3	4.7	95.9	4.1

More specifically, female Health graduates earn 5.1% less than their male counterparts (\$79,500 compared to \$83,800), an earnings difference of \$4,300 in the first year. After five years, this difference increases to 20.2% (\$23,000). Among Social Sciences graduates, women earn 6.3% (\$3,400) less in the first year, but the difference reaches 14.5% (\$15,700) after five years.

4.3 Earnings of International Student Graduates

This subsection examines the earnings patterns of both Canadian and international student graduates who completed their studies at Canadian PSE institutions.

The first comparisons are by credential, the next across fields of study within each credential.⁵⁵

As shown in [Table 8](#), there is a substantial

reduction in the share of international graduates after the sample restrictions are imposed, particularly within the master's and doctoral degree graduate samples.

This is driven in large part by the non-filer restriction, which captures graduates who leave the country and thus do not file taxes in Canada.

However, there is little change between one and five years following graduation, suggesting that international students who leave the country tend to do so immediately after graduating.

Overall, international students comprise 7.5% of all graduates before the restrictions are imposed, and 4.7% in the first year after graduation. The share of international students is lowest for college-level certificates, at 2.8%. It increases to 7.2% and 6.6% for college-level diplomas and bachelor's degrees, and is highest at 15.8% and 13.8% for master's and doctoral degrees.⁵⁶

⁵⁵ International student graduates represent non-permanent residents of Canada. They are compared to Canadian students, representing persons who were born Canadian, are naturalized Canadian citizens, or are resident non-citizens enrolled as Canadian students. International student status is captured at graduation in the Postsecondary Student Information System (PSIS), and not in the tax data. Immigration status may change after graduation, but this information is not currently available on the ELMLP.

⁵⁶ The balanced-panel sample selection design used by Statistics Canada (2018c) reduces the corresponding sample size of international students to such an extent that there were an insufficient number of observations to release the distribution of graduates or their earnings by international student status in the tax data. Immigration status may change after graduation, but this information is not currently available on the ELMLP.

Results for professional degree graduates cannot be reported because of small sample sizes for international students.

With respect to the distribution of graduates by credential and international student status, [Figure 25](#) indicates that, compared to Canadian graduates, international student PSE graduates are less likely to hold college-level certificates, college-level diplomas, and bachelor's degrees, but are more likely to have master's and doctoral degrees. After the sample restrictions are imposed, the distributions remain roughly similar, with the notable exception of a higher representation of college-level diplomas among international student graduates.

Earnings Differences between Canadian & International Students by Credential

The earnings of Canadian and international graduates in the years following graduation differ substantially at each credential level, as shown in [Figure 26](#). Since Canadian graduates represent the vast majority of post-secondary education graduates, their earnings trajectories by credential are almost identical to the earnings for all graduates taken together (see [Figure 2](#)).

In comparing the earnings of Canadian and international student graduates at different credential levels, [Figure 26](#) highlights that international student

graduates earn less than Canadian graduates in all years, with one exception: college-level certificate graduates, for whom earnings are essentially the same for both groups. For all other credentials, the differences in earnings are greatest in the first year after graduation; and in all cases, the differences narrow in relative terms over time, albeit to varying degrees.

The differences in earnings between international student and Canadian graduates with college-level diplomas and bachelor's degrees in the first year after graduation are 19.7% (\$6,900) and 22.2% (\$9,200), respectively.⁵⁷

While differences in earnings narrow over time in relative terms, the absolute differences (i.e., dollar amount) are fairly consistent for these two credentials.

The differences in earnings are by far the greatest at the master's level, where international graduates earn 38.2% (\$25,700) less than Canadian graduates in the first year, with these differences narrowing to 20.0% (\$16,800) five years after graduation. Notably, five years after graduation, international master's degree graduates earn only as much as Canadian master's degree graduates earn in their first year.

Finally, for doctoral graduates, the earnings differences by international student status start at 17.1% (\$10,400) and narrow to 5.4% (\$4,500). However, given the small sample size of international students, the differences

⁵⁷ As in [section 4.2](#), which focuses on the earnings differentials between men and women, earnings differentials reported are calculated as $\left(\frac{E_i - E_c}{E_c}\right)$, expressed in percentage terms, where E_c and E_i represent the average earnings of Canadian and international students respectively; in other words, how much less international students earn than Canadian students in relative terms.

Figure 25: Distributions (%) of PSE Credentials by International Student Status, Before Sample Restrictions and One Year After Sample Restrictions

LEGEND

- COLLEGE-LEVEL CERTIFICATE
- COLLEGE-LEVEL DIPLOMA
- BACHELOR'S DEGREE
- MASTER'S DEGREE
- DOCTORAL DEGREE

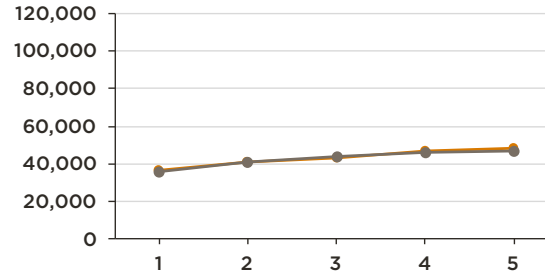


Figure 26: Average Earnings of International and Canadian PSE Graduates by Credential (2016 Constant \$)

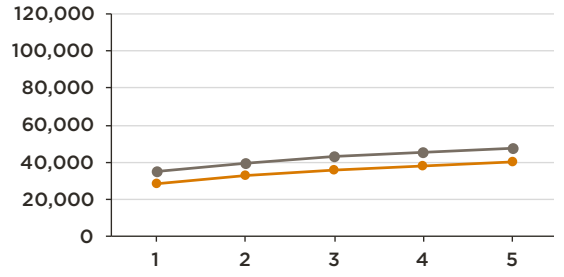
LEGEND

- INTERNATIONAL
- CANADIAN

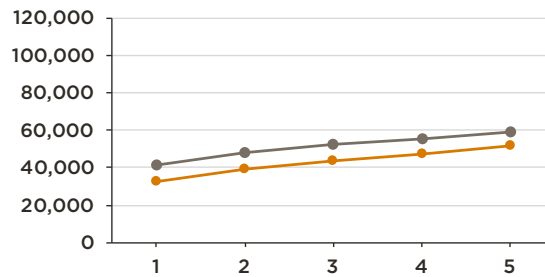
College-level Certificate



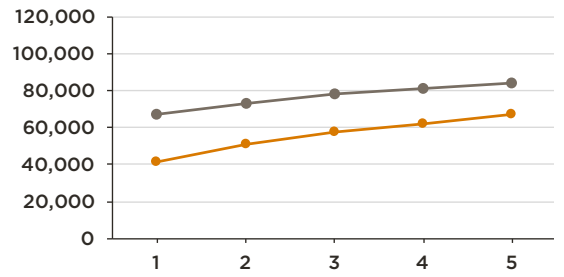
College-level Diploma



Bachelor's Degree



Master's Degree



Doctoral Degree

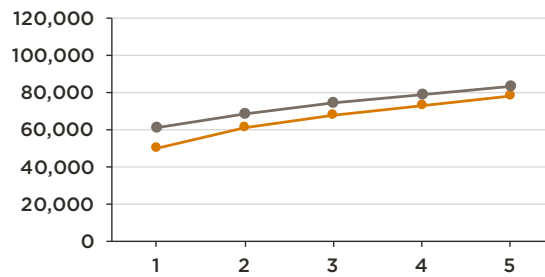


Table 9: Share of International Student Graduates (%) by Credential and Field of Study, One Year After Graduation

	College-Level Diploma	Bachelor's Degree	Master's Degree	Doctoral Degree
Education	4.1	0.3	1.9	-
Arts	3.8	4.1	7.1	-
Humanities	-	2.4	4.5	6.5
Social Sciences	4.2	4.4	6.5	-
Business	9.8	6.7	7.7	-
Sciences	23.3	4.2	9.2	8.0
Math & Computer Science	9.7	11.9	18.7	17.4
Engineering	5.9	6.7	18.4	15.7
Natural Resources	-	5.1	12.0	-
Health	2.6	1.0	1.4	-
Personal & Protective Services	2.8			
Other	2.8	-	-	3.5
OVERALL	5.8	4.0	7.9	7.9

five years after graduation are not statistically significant. Earnings Differences between Canadian & International Students by Field of Study

Earnings Differences between Canadian & International Students by Field of Study

Following this broad credential overview, this subsection digs deeper to track and compare the post-graduation earnings of Canadian and international students by field of study within each credential.

Table 9 shows that among college-level diploma graduates, the share of international students is higher in the Sciences than in other fields of study; at the bachelor's degree level, the share is higher in Math & Computer Science.

In the case of master's and doctoral degree graduates, international students are more represented in both Math & Computer Science and Engineering than in other fields of study.

Although we are able to observe international student post-graduation earnings for college-level certificate graduates taken all together at the credential level, the sample sizes within are too small to be reported at the field of study level. As a result, comparisons of Canadian and international student graduates' earnings by field of study is possible for only four credentials.

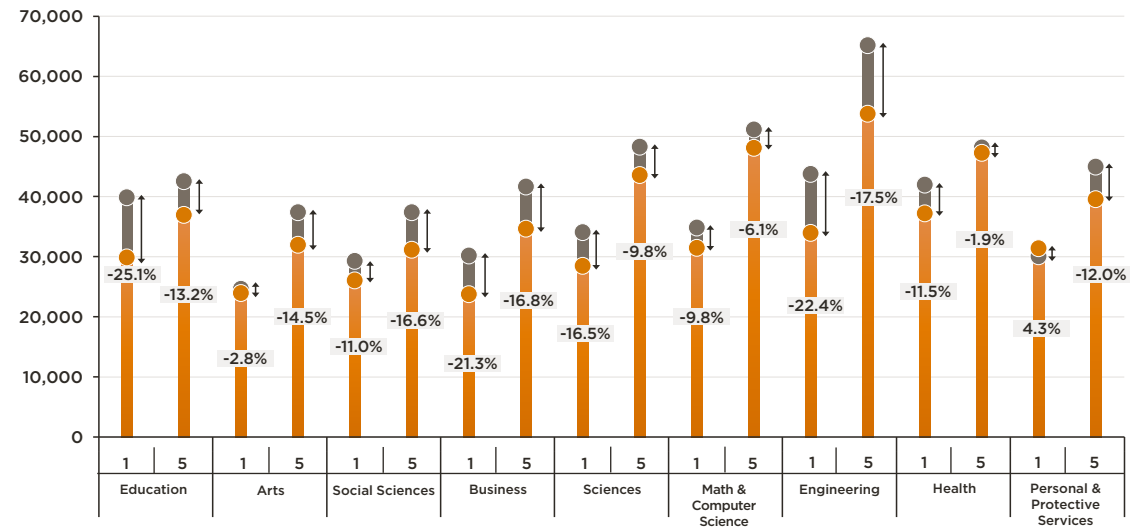
COLLEGE-LEVEL DIPLOMAS

Overall, as was seen above, international students with college-level diplomas earn 19.7% less than Canadians (\$6,900) with the same credential in the first year following graduation. This difference

Figure 27: International Student Earnings Differentials of College-level Diploma Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- INTERNATIONAL STUDENTS
- CANADIAN STUDENTS



narrows to 14.2% (with similar absolute differences of \$6,700 at the generally higher earnings levels) in the fifth year. Using the same style of graphs as in Section 4.2, the following figures plot the first and fifth year earnings of Canadian and international student graduates and show how much less international students earn than Canadian students in percentage terms. Figure 27 shows that within each field of study, international student graduates earn less than their Canadian counterparts, with the exception of Personal & Protective Services graduates' in the first year, where earnings are very similar for the two groups.

The largest relative earnings differences in the first year are seen among Education graduates, where international student graduates earn

25.1% (\$10,000) less than their Canadian counterparts. However, five years after graduation, this difference narrows to 13.2% (\$5,600).

Conversely, international graduates in Personal & Protective Services earn 4.3% (\$1,300) more than Canadian graduates in the first year. From the second year onward, however, Canadian graduates earn more, and by the fifth year, international student graduates earn 12.0% (\$5,400) less. Across all other fields, international student graduates with college-level diplomas earn less than Canadian graduates in every year.

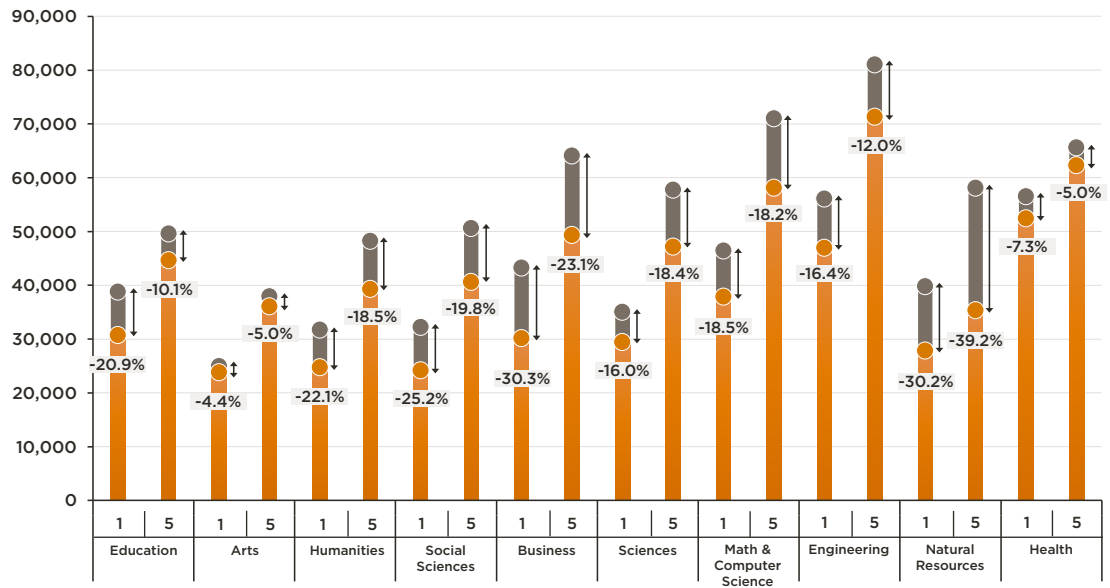
BACHELOR'S DEGREES

Overall, international students with bachelor's degrees earn 22.2% (\$9,200) less than Canadian graduates with the same credential in the first year after

Figure 28: International Student Earnings Differentials of Bachelor’s Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- INTERNATIONAL STUDENTS
- CANADIAN STUDENTS



graduation, differences that narrow to 12.2% (\$7,200) five years out.

International student graduates also earn substantially less than Canadians in most specific fields of study at the bachelor’s level (Figure 28). The two exceptions, where the differences are more moderate, are in Health and the Arts, where international student graduates earn 7.3% (\$4,100) and 4.4% (\$1,100) less than their Canadian counterparts, respectively, one year out. In the Arts, these differences remain relatively stable, reaching 5.0% (\$1,900) five years out, while in Health fields the differences narrow slightly, also to 5.0% (\$3,300).

The three fields of study in which international student graduates earn the least compared to their Canadian counterparts in the first year after

graduation are Business at 30.3% (\$13,100), Natural Resources also at 30.2% (\$12,000), and the Social Sciences at 25.2% (\$8,100). Five years out, these fields still have the greatest differences in earnings, although they narrow for Business and Social Science graduates to 23.1% (\$14,800) and 19.8% (\$10,000), respectively. In contrast, the differences widen substantially for Natural Resource graduates such that international student graduates earn 39.2% (\$22,800) less than Canadian graduates five years after graduation.

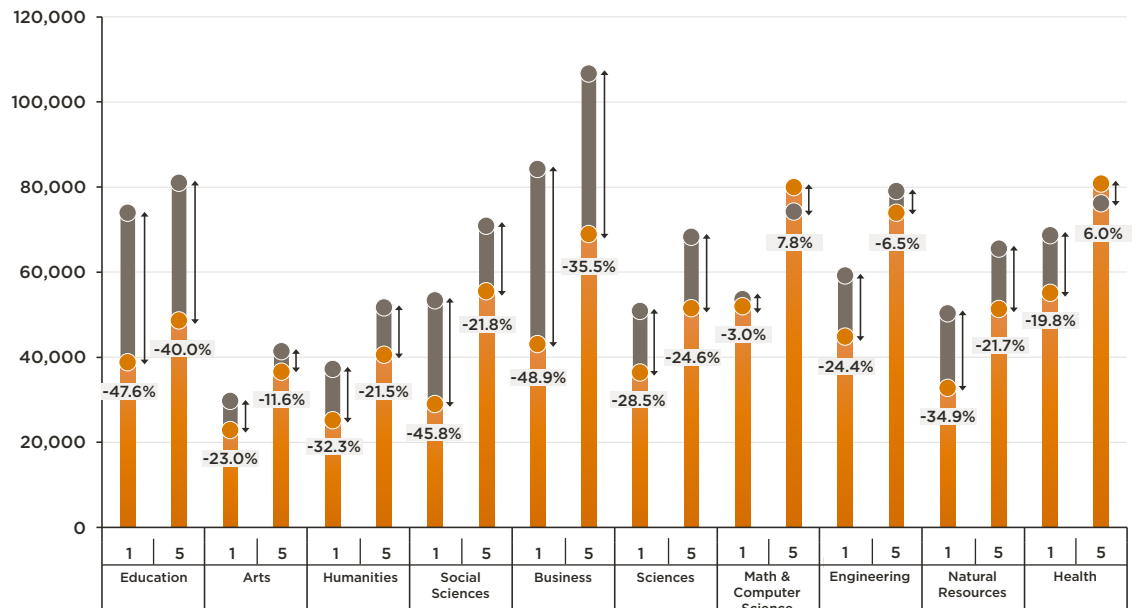
MASTER’S DEGREES

At the aggregate level, as shown in Figure 26, master’s degree holders have the greatest earnings differences between international and Canadian graduates across all credentials. Overall,

Figure 29: International Student Earnings Differentials of Master’s Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- INTERNATIONAL STUDENTS
- CANADIAN STUDENTS



international student graduates with a master’s degree earn \$25,700 (or 38.2%) less than Canadian graduates with the same credential in the first year after graduation, a difference that decreases to \$16,800 (20.0%) five years out.

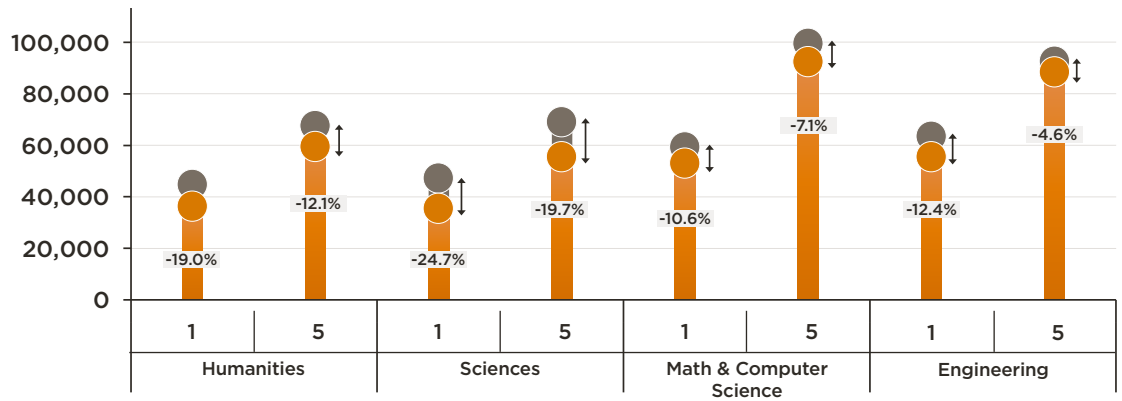
In the first year following graduation, international student graduates earn less than Canadian graduates in all fields, but the differences vary widely (Figure 29). At the low end, international student graduates in Math & Computer Science earn 3.0% (\$1,600) less than Canadians. At the other extreme, in Education and Business international student graduates earn, respectively, 47.6% (\$35,100) and 48.9% (\$41,100) less than their Canadian counterparts one year out.

Five years after graduation, international student graduates with master’s degrees in Math & Computer Science and Health earn 7.8% (\$5,800) and 6.0% (\$4,600) more than Canadian graduates. In the other eight fields of study, however, international student graduates earn substantially less than Canadian graduates. While the differences have narrowed relative to the first year following graduation, Business and Education still have the largest differences, with 35.5% (\$37,800) in the former and 40.0% (\$32,400) in the latter.

Figure 30: International Student Earnings Differentials of Doctoral Degree Graduates by Field of Study, One and Five Years after Graduation

LEGEND

- INTERNATIONAL STUDENTS
- CANADIAN STUDENTS



DOCTORAL DEGREES

Figure 30 shows that in the four fields of study available for doctoral degree graduates, international students earn less than their Canadian counterparts in each case, both one year and five years following graduation.

The earnings differences are the smallest in the first year for Engineering graduates, at 12.4% (\$7,900), and Math & Computer Science graduates, at 10.6% (\$6,300). In both cases, the differences are smaller in the fifth year, 4.6% (\$4,300) for Engineering and 7.1% (\$7,100) for Math & Computer Science.

The other two fields, Humanities and Sciences, are associated with substantially larger differences in earnings. In the Humanities, international student graduates start with earnings 19.0% (\$8,500) lower than Canadians and earn 12.1% (\$8,200) less in year five. International students with doctoral degrees in the Sciences have

the largest earnings differential, starting at 24.7% (\$11,700) less, which narrows slightly to 19.7% (\$13,600) in the fifth year after graduation.

5.0

Discussion of the Findings

This report presents new and extensive evidence on the early career earnings of graduates from Canadian colleges and universities by credential and field of study based on the Education and Labour Market Longitudinal Platform (ELMLP). The purpose of this work is to provide detailed descriptive findings on PSE graduates' earnings rather than addressing any of the broad range of analytical issues that characterize the general literature on graduates' earnings. Nevertheless, we identify broad similarities, and a few differences, between our findings and those discussed in the Canadian literature.

At the credential level, we find that professional degree graduates consistently earn more than those with master's and doctoral degrees, the latter two tending to have similar starting earnings levels and subsequent growth rates. Bachelor's degree graduates earn less than master's and doctoral degree holders, but more than those who graduated with college-level certificates and diplomas. Those with college-level certificates and diplomas also tend to have similar earnings trajectories. These findings are consistent with those of Taillon and Paju (1999), Walters, White and Maxim (2004), Finnie et al. (2016),

Galarneau, Hinchley, and Ntwari (2017), and Statistics Canada (2018b), among others.

Earnings increase over the five years following graduation for all credentials, but at different rates, which is consistent with other studies using longitudinal tax data (e.g., Heisz, 2001; Finnie et al., 2014; 2016; Galarneau, Hinchley, & Ntwari, 2017; Statistics Canada, 2018b). This aspect of the analysis shows the value of tracking the earnings of the same graduates over time on a year-by-year basis following graduation.

Earnings trajectories at each credential level are very similar across the five graduation cohorts. Some studies find significant differences across cohorts of graduates, but these involve comparisons over a longer period, across specific variations in the business cycle, or in a specific field. For example, Frenette (2019a) compares a 1991 cohort of graduates to a 2001 cohort, Oreopoulos et al. (2012) look at the effect of graduating during a time of economic downturn, and Finnie et al. (2018) track ICT graduates over the dot-com boom and subsequent bust, while Finnie et al. (2016) find small differences across cohorts before and after the 2008 recession.

Earnings vary widely across individuals within a given credential. The distribution of earnings is wider in absolute dollar terms within master's, doctoral, and professional degrees than within bachelor's degrees and college-level diplomas and certificates. The distributions are fairly stable over the years following graduation for doctoral degrees, whereas they widen for all other credentials, especially for master's and professional degrees. Previous studies have not tended to look at earnings distributions, but an exception is Finnie et al. (2014; 2016), who find similar patterns for diploma and bachelor's degree graduates.

By field of study, Engineering and Math & Computer Science graduates have the highest earnings among college-level certificates and diplomas, as well as bachelor's degrees, while Business graduates have the highest earnings among those with master's and doctoral degrees. These findings are in line with Finnie (2001), Finnie and Frenette (2003), Heisz (2001), Finnie et al. (2014; 2016), Galarneau et al. (2017), and Statistics Canada (2018b), who all find that graduates in applied fields tend to earn more than others.

However, the literature also points to the importance of observing longer-term labour market outcomes by field of study. For instance, we find that Health graduates with bachelor's degrees start with the second highest earnings at their credential level and, although they have very low earnings growth, still have among the highest earnings levels five years out. In comparison, according to Finnie et al.

(2014; 2016), Health graduates' low earnings growth translates into middle-of-the-pack earnings levels eight years out and among the lowest 13 years out.

At the credential level, we find that women earn less than men in their first year after graduation, with earnings differences ranging from 2% to 21%. In all cases, the differences widen markedly over time. By the fifth year, the difference in average earnings between men and women is the greatest, at 34%, for college-level certificate graduates, and the smallest, at 16%, for doctoral degree graduates. These earnings differences are broadly consistent with numerous other studies in what amounts to a vast literature, including Finnie and Wannell (2004), Finnie et al. (2014; 2016), Galarneau, Hinchley, and Ntwari (2017), and Statistics Canada (2018b).

Substantial differences in earnings by gender can also be seen in specific fields of study within credentials. Five years after graduation, women earn less than their male counterparts in every field of study at all credential levels. The greatest gender earnings differences are seen for graduates with college-level certificates and diplomas in Education, where women earn 44% less than men, and for master's degree holders in Business, where women earn 32% less than men.

For all credentials, except college-level certificates, international student graduates earn less, on average, than Canadian graduates, which is consistent with the findings reported in Hou and Lu (2017).⁵⁸ In contrast to what we find by gender, however, the

⁵⁸ It is important to note, however, that Hou and Lu (2017) compare Canadian-educated immigrants to the Canadian-born population, as opposed to international students per se as in this analysis.

earnings differential between these two groups of graduates generally narrows in relative terms over time across all credentials.

However, the differences in earnings between international student graduates and Canadian graduates vary substantially by field of study. International student graduates still tend to earn less than their Canadian counterparts overall with the largest earnings differential observed in Education at the master's degree level, where they earn 40.0% less than Canadian graduates five years after graduation. Conversely, at the master's degree level, international student graduates earn 7.8% and 6.0% more than do Canadians in the Math & Computer Science and Health fields. Very little work examining the post-graduation earnings of international students by field of study has been done, but the planned addition of the Longitudinal Immigration Database (IMDB) to the ELMLP presents a great opportunity to further explore these patterns.

While the current report presents new evidence in a critical area of labour market information, a number of points regarding their meaning and interpretation are worth noting (see also [section 3.1](#)). In particular, the analysis is intended simply to track the mean earnings of PSE graduates in a comprehensive manner and present them descriptively at the credential and field of study levels. These findings cannot, however, be interpreted as representing causal effects nor can they be used to predict the earnings of any particular individual who may decide to pursue studies at any of these credential levels or within any of

these fields of study.

An important next step for this line of research will be to use regression techniques and other analytical frameworks to identify the contribution of various factors to the observed earnings differences, and then to identify earnings patterns by credential and field of study after controlling for such influences. The initial descriptive analysis presented here, however, provides a natural starting point for this type of research.

In addition, this analysis presents annual earnings — the only measure available — and therefore does not take into consideration a range of other factors, such as hours and weeks worked, hourly wages, or any indicators of job quality or satisfaction. Some of these issues may be resolved to some degree as further data linkages are made, including to the census.

Finally, the earnings presented here capture outcomes of a specific set of graduates at each credential level; that is, those who do not go on to further studies. An alternative, broader, more extended perspective would be gained by following all graduates through any subsequent schooling and capturing their outcomes after all schooling is completed — something that could be done in the future, especially as more years of post-graduation data are added to the ELMLP.

6.0

Conclusion

This report has presented the results of an extensive analysis of the early career labour market earnings of Canadian PSE graduates. The objective is to provide valuable new information to a wide range of stakeholders in the PSE system — students, parents, PSE institutions, researchers, policy makers, and the broader Canadian public.

The analysis is based on the Education and Labour Market Longitudinal Platform (ELMLP), recently developed by Statistics Canada and Employment and Social Development Canada (ESDC). The analysis exploits the remarkable strengths of the ELMLP: 1) a near complete representation of the population of all Canadian PSE students (and graduates); 2) the opportunity to link students to accurate measures of their earnings taken from tax data; and 3) the ability to track earnings following graduation separately for each cohort on a year-by-year basis.

We identify all students who graduated from a Canadian PSE institution from 2010 through 2014 and then track their earnings from the first year following graduation through 2015. This tracking of starting earnings levels and subsequent earnings growth is done separately for each cohort. This report focuses specifically on the 2010 cohort, which

can be followed for the longest period after graduation (i.e., five years), while the [interactive dashboard](#) presents the results for the other cohorts.

This report, therefore, provides new and comprehensive evidence of Canadian PSE graduates' post-schooling earnings by credential and field of study. After establishing these broader and more detailed earnings patterns among college and university graduates, a forthcoming EPRI-LMIC companion report will explore the earnings of those who complete apprenticeship programs. Taken together, these reports and related materials, including the [interactive dashboard](#), will provide expansive new sets of information and insights on the earnings of Canadian who undertake post-secondary education and training.

7.0

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