Catalogue no. 75-006-X
ISSN 2291-0840

Insights on Canadian Society

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Release date: September 26, 2018

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Results from the 2016 Census: Is field of study a factor in the payoff of a graduate degree?

by Katherine Wall, John Zhao, Sarah-Jane Ferguson and Carlos Rodriguez

Today, Insights on Canadian Society is releasing a study based on 2016 Census data. This study uses Census data on the highest level of education, field of study, and earnings.

Overview of the study

More and more Canadians are pursuing graduate studies, often to increase their chances of getting a better-paying job. Using data from the 2016 Census, this study examines the extent to which median earnings of workers with a master's degree or doctorate differ from their counterparts with a bachelor's degree, focusing on differences across fields of study. The target population includes paid employees aged 30 to 59 who worked full year and full time during the year preceding the census, and whose highest educational qualification was obtained in Canada.

- Among Canadians working full year and full time who had a master's degree, business and related studies was the most common field of study, accounting for one-quarter (25%) of master's degrees. The next most common fields were education and teaching (13%), and social and behavioural sciences (11%).
- In contrast, more than one-half (58%) of earned doctorates were in science, technology, engineering and mathematics (STEM) fields. More than one-third were in the science and science technology STEM fields.
- In non-STEM (BHASE) fields, men and women with a master's degree earned 17% and 14% more, respectively, than their counterparts with a bachelor's degree. In most cases, these higher earnings were associated with their having a different occupational profile than those with a bachelor's degree.
- For both men and women, the earnings of those with a master's degree in STEM differed little from their counterparts with a bachelor's degree, largely because of fewer differences in their occupational profiles.
- Within specific fields of study, the largest differences in earnings were seen in business and related studies. In this field, men and women with a master's degree earned 27% and 28% more, respectively, than those with a bachelor's degree.

Introduction

Canadians are increasingly highly educated, with many continuing their education beyond the bachelor's level to complete a master's degree or an earned doctorate. From 2006 to 2016, the number of Canadians aged 25 to 64 with a master's degree or an earned doctorate rose by more than 40%, to nearly 1.3 million (representing 7% of the population in this age group). Among younger people, the proportion was even larger: close to 9% of Canadians aged 35 to 44 had a master's degree or a doctorate, compared with 5% of those aged 55 to 64.[1]

While large investments of time and money (including foregone earnings while in school) are required to complete any degree, this is particularly true for higher degrees. Hence, the earnings associated with these graduate degrees are of key importance to students making decisions about their education. This information is also important for policy makers, who seek to understand the labour demand for master's and doctorate degree holders in different fields, particularly given the growth of the knowledge-based economy.[2]

There is a substantial body of literature demonstrating that the earnings of people with the same level of education can vary widely by field of study. Most studies have found that graduates of more applied fields, including engineering, health and business, have higher earnings than graduates of the biological sciences, humanities, fine arts and social sciences fields.[3] There is also evidence that the earnings differences between fields become smaller as the time since graduation increases.[4]

Several studies have specifically examined the earnings of graduate degrees by field of study.[5] They have shown that the fields of study associated with the highest earnings are different for graduate degrees than for bachelor's degrees; for example, many engineering fields have above-average wages at the bachelor's level, but not at the master's level.[6]

This article makes several contributions to the literature. First, it uses recent data from the 2016 Census to examine the earnings difference between those who have a bachelor's degree and those who have a master's degree or a doctorate within each field of study.[7] The study does this by using a quantile regression to generate the predicted median earnings associated with each field of study for each level of education (see the Data sources, methods and definitions section), which allows it to control for other factors that may affect earnings. If graduate degrees in a certain field of study are associated with earnings similar to those of a bachelor's degree in the same field, there may be a lower financial incentive for students in that field to pursue graduate studies.[8]

Second, this article is the first to examine the earnings of graduate degree holders using the new Statistics Canada classification of fields of study known as STEM and BHASE. STEM fields include science, technology, engineering and mathematics, while BHASE (also referred to as non-STEM) fields include business, health, arts, social sciences and education.[9] STEM fields have attracted considerable policy interest as contributors to innovation and economic competitiveness.[10] At the same time, BHASE fields bring much needed skills in the Canadian labour market, for instance in the legal system, the health care system, schools, and businesses. This classification allows analysis of the labour market outcomes of STEM graduates compared with those in other fields of study.

The target population for this article includes paid employees aged 30 to 59 who worked full year and full time during the year preceding the census (in 2015) and whose highest educational qualification was a bachelor's, master's or earned doctorate degree they obtained in Canada (non-permanent residents are excluded).[11] The article will begin by providing contextual information about the distribution of fields of study at the bachelor's, master's and doctoral levels. It will then proceed to a discussion of the earnings of bachelor's, master's and doctorate degree holders, for the aggregate STEM and BHASE groupings and for specific fields of study.

More than three-quarters of bachelor's and master's degrees were in BHASE fields, while the majority of doctorates were in STEM fields

Among adult Canadians working as full-year, full-time employees, more than three-quarters of bachelor's degrees (77%) and master's degrees (78%) were in BHASE (non-STEM) fields (Table 1). At the master's level, business and related studies was the most common field of study, accounting for one-quarter (25%) of master's degrees. The next most common fields were education and teaching (13%) and social and behavioural sciences (11%). These three BHASE fields were also the three most common fields of study at the bachelor's level.

In contrast, more than one-half (58%) of earned doctorates were in STEM fields. More than one-third (37%) of doctorates were in the STEM science and science technology fields, which accounted for less than 10% of all bachelor's and master's degrees. Another 16% of doctorates were in the STEM engineering field, compared with 9% of bachelor's and master's degrees. The most common BHASE field for doctorates was social and behavioural sciences, at over 17%. Degrees in business and related studies were much less common at the doctoral level than at the bachelor's and master's levels, making up less than 3% of earned doctorates.

Table 1
Distribution of bachelor's, master's and doctorate degree holders aged 30 to 59 who worked as full-year, full-time paid employees, by selected STEM and BHASE fields of study, 2016

	Bachelor's degree	Master's degree	Earned doctorate
		number	
All fields of study	**1,101,575**	**300,770**	**45,970**
		percent	
All fields of study[1]	**100**	**100**	**100**
STEM	**23.1**	**22.4**	**57.8**
Science and science technology	**8.2**	**9.1**	**36.7**
Physical and chemical sciences	1.6	2.4	12.1
Biological sciences	4.6	5.4	23.3
General and integrated sciences	2.0	1.2	1.3
Engineering and engineering technology	**9.2**	**9.1**	**15.9**
Engineering	9.2	9.0	15.9
Mathematics and computer and information science	**5.7**	**4.3**	**5.1**
Mathematics and related studies	1.8	1.3	2.6
Computer and information science	3.9	3.0	2.5
BHASE (non-STEM)	**76.9**	**77.6**	**42.2**
Business and administration	**19.5**	**27.2**	**2.9**
Business and related studies	19.4	25.1	2.9
Public administration	0.1	2.1	0.0
Arts and humanities	**11.2**	**7.7**	**9.4**
Arts	2.6	1.3	0.9
Humanities	8.7	6.4	8.5
Social and behavioural sciences	**18.5**	**11.4**	**17.5**
Legal professions and studies	**2.0**	**1.4**	**1.8**
Law	1.8	1.4	1.8
Health care	**6.5**	**6.7**	**4.0**
Nursing	4.3	2.1	0.8
Pharmacy and related programs	0.8	0.3	0.7
Health care, n.e.c.	1.5	4.2	2.3
Education and teaching	**14.1**	**13.4**	**4.5**
Trades, services, natural resources and conservation	**5.1**	**9.7**	**2.1**
Agriculture and natural resources operations and management	1.1	1.7	0.9
Mechanics and repair, architecture, construction and precision production[2]	0.7	2.1	0.2
Social work and related programs	1.7	3.4	0.6
BHASE (non-STEM) programs, n.e.c.[3]	1.3	2.1	0.3

1. Subcategories may not sum to totals due to the table omitting some very small subcategories.
2. At the university level, the most common field of study in this category is architecture and related services.
3. This category is made up of selected subfields of parks, recreation, leisure and fitness studies, along with library science, and multidisciplinary/interdisciplinary studies, other.
Source: Statistics Canada, Census of Population, 2016.

There were differences in the fields of study pursued by women and men; men were more likely to study in STEM fields while women were more likely to study in BHASE fields (Table 2). At all levels (bachelor's, master's and doctoral), engineering was more common among men than women. For example, 15% of men who had a master's degree and 23% of those who had a doctorate studied in engineering. In comparison, less than 6% of women with a doctorate and over 3% of those with a master's degree graduated from an engineering program.

Men were also more likely than women to study in the BHASE business and related studies field, particularly at the master's level. That field accounted for one-third (33%) of master's degrees among men compared with less than one-fifth (18%) among women.

Conversely, education and teaching was more common among women than men at all levels. For example, at the master's level, it made up 19% of degrees among women and was their most common field of study, while it made up 8% of master's degrees among men. Social and behavioural sciences made up about one-quarter of doctorates for women, compared with less than one-half that proportion (12%) for men, mainly because women were more likely than men to earn a doctorate in psychology (14% versus 4%).[12]

The earnings difference associated with graduate degrees was larger among women than men

Taken together, women with a master's degree earned 13% more than those with a bachelor's degree, and women with a doctorate earned 10% more than those with a master's degree (Chart 1). Among men, the differences were smaller, at 11% for a master's degree over a bachelor's degree, and 5% for a doctorate over a master's degree. This is consistent with literature finding that the returns from university degrees are larger for women than men.[13] Notably, the earnings advantage of having a master's degree was larger than that of a doctorate, despite a master's degree typically taking two years to complete while a doctorate typically takes five to six years.[14]

Table 2
Distribution of bachelor's, master's and doctorate degree holders aged 30 to 59 who worked as full-year, full-time paid employees, men and women, by selected STEM and BHASE fields of study, Canada, 2016

	Women			Men		
	Bachelor's degree	Master's degree	Earned doctorate	Bachelor's degree	Master's degree	Earned doctorate
	number					
All fields of study	**585,185**	**153,930**	**18,505**	**516,395**	**146,840**	**27,460**
	percent					
All fields of study[1]	**100**	**100**	**100**	**100**	**100**	**100**
STEM	**12.6**	**15.2**	**42.1**	**34.9**	**30.0**	**68.4**
Science and science technology	**7.6**	**9.0**	**33.5**	**8.9**	**9.1**	**38.9**
Physical and chemical sciences	0.9	1.6	7.1	2.4	3.2	15.5
Biological sciences	4.8	6.2	25.1	4.4	4.6	22.1
General and integrated sciences	1.9	1.2	1.3	2.1	1.3	1.3
Engineering and engineering technology	**2.4**	**3.5**	**5.9**	**16.9**	**14.9**	**22.7**
Engineering	2.4	3.4	5.9	16.9	14.9	22.6
Mathematics and computer and information science	**2.7**	**2.8**	**2.7**	**9.1**	**5.9**	**6.8**
Mathematics and related studies	1.3	1.0	1.8	2.4	1.6	3.2
Computer and information science	1.4	1.8	0.9	6.7	4.3	3.6
BHASE (non-STEM)	**87.4**	**84.8**	**58.0**	**65.1**	**70.0**	**31.6**
Business and administration	**17.1**	**20.2**	**2.9**	**22.3**	**34.5**	**3.0**
Business and related studies	17.0	17.9	2.8	22.2	32.6	2.9
Public administration	0.1	2.2	0.0	0.1	1.9	0.0
Arts and humanities	**12.4**	**7.6**	**10.6**	**9.9**	**7.8**	**8.6**
Arts	2.9	1.5	1.1	2.2	1.1	0.9
Humanities	9.5	6.1	9.6	7.7	6.7	7.8
Social and behavioural sciences	**20.2**	**13.6**	**25.5**	**16.6**	**9.1**	**12.1**
Legal professions and studies	**2.0**	**1.5**	**1.9**	**1.9**	**1.3**	**1.6**
Law	1.9	1.5	1.9	1.8	1.3	1.6
Health care	**10.4**	**10.9**	**7.0**	**2.1**	**2.4**	**2.0**
Nursing	7.3	3.7	1.8	0.9	0.3	0.0
Pharmacy and related programs	0.9	0.4	1.2	0.6	0.2	0.3
Health care, n.e.c.	2.2	6.6	3.7	0.6	1.8	1.3
Education and teaching	**19.9**	**18.6**	**7.4**	**7.6**	**8.0**	**2.6**
Trades, services, natural resources and conservation	**5.4**	**12.4**	**2.7**	**4.7**	**6.9**	**1.7**
Agriculture and natural resources operations and management	0.7	1.7	0.7	1.5	1.8	1.0
Mechanics and repair, architecture, construction and precision production[2]	0.5	1.9	0.2	0.9	2.4	0.2
Social work and related programs	2.7	5.7	1.2	0.6	1.0	0.1
BHASE (non-STEM) programs, n.e.c.[3]	1.2	3.0	0.5	1.4	1.2	0.2

1. Subcategories may not sum to totals due to the table omitting some very small subcategories.
2. At the university level, the most common field of study in this category is architecture and related services.
3. This category is made up of selected subfields of parks, recreation, leisure and fitness studies, along with library science, and multidisciplinary/interdisciplinary studies, other.
Source: Statistics Canada, Census of Population, 2016.

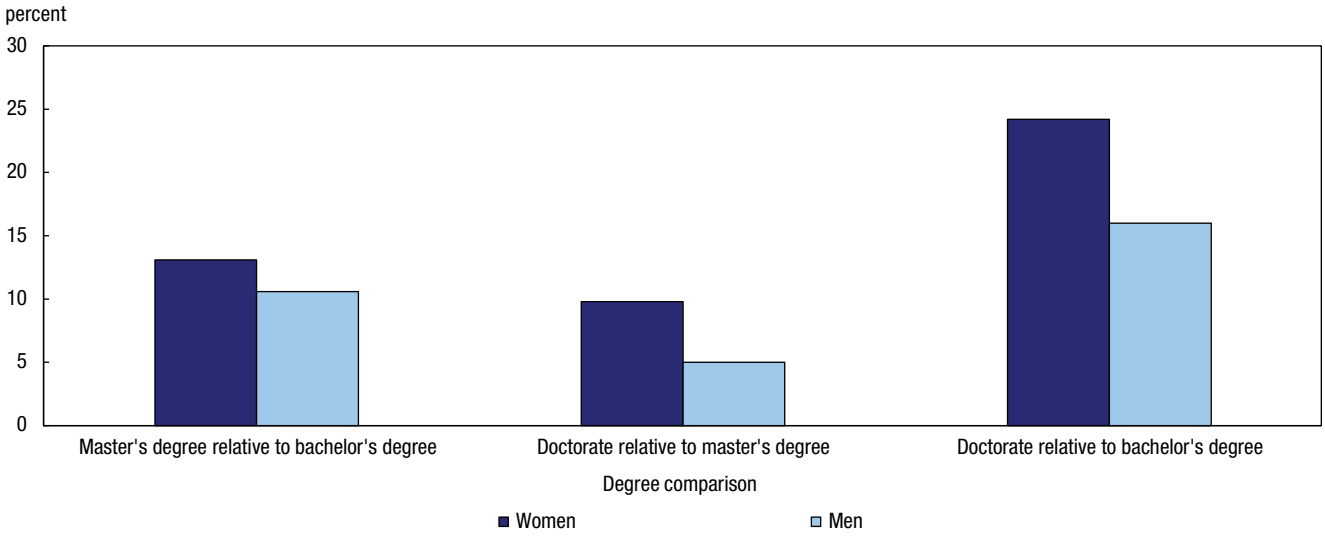
However, the results described above are in part due to the composition of fields of study at the bachelor's, master's and doctoral levels. Men with a bachelor's degree, for instance, are more likely than women to have a degree in STEM, which typically pays more than BHASE fields, at least at the bachelor's level. It is therefore more informative to break down earnings advantages by field of study.

The earnings advantage associated with a master's degree was larger in BHASE fields than in STEM fields

In 2016, women with a bachelor's degree in BHASE who worked full year and full time earned $74,700, compared with $80,000 for their STEM counterparts (Chart 2). Among men with a bachelor's degree who worked full year and full time, the difference was even larger ($85,500 for those in BHASE fields versus $99,700 for those in STEM fields).[15]

At the master's level, however, there was little difference in median earnings between full-year, full-time workers with a degree in BHASE and those with a degree in STEM, which suggests that having a master's degree in BHASE has a greater influence on earnings than having a master's degree in STEM.

Chart 1
Difference in predicted median earnings between types of university degrees, women and men aged 30 to 59 who worked as full-year, full-time paid employees, 2015



Source: Statistics Canada, Census of Population, 2016.

Specifically, men and women with a master's degree in a BHASE field earned 17% and 14% more, respectively, than their counterparts who only had a bachelor's degree in BHASE (Chart 3). In contrast, among those who had a master's degree in a STEM field, the same percentages were 6% for women and 1% for men.[16]

The situation was somewhat different between men and women who had a doctorate. Among women, those with a doctorate in BHASE earned 13% more than those with a master's degree, while those with a doctorate in STEM earned 4% more. Likewise, women doctorate holders in BHASE fields had higher earnings, at $96,400, than doctorate holders in STEM fields, at $88,400.

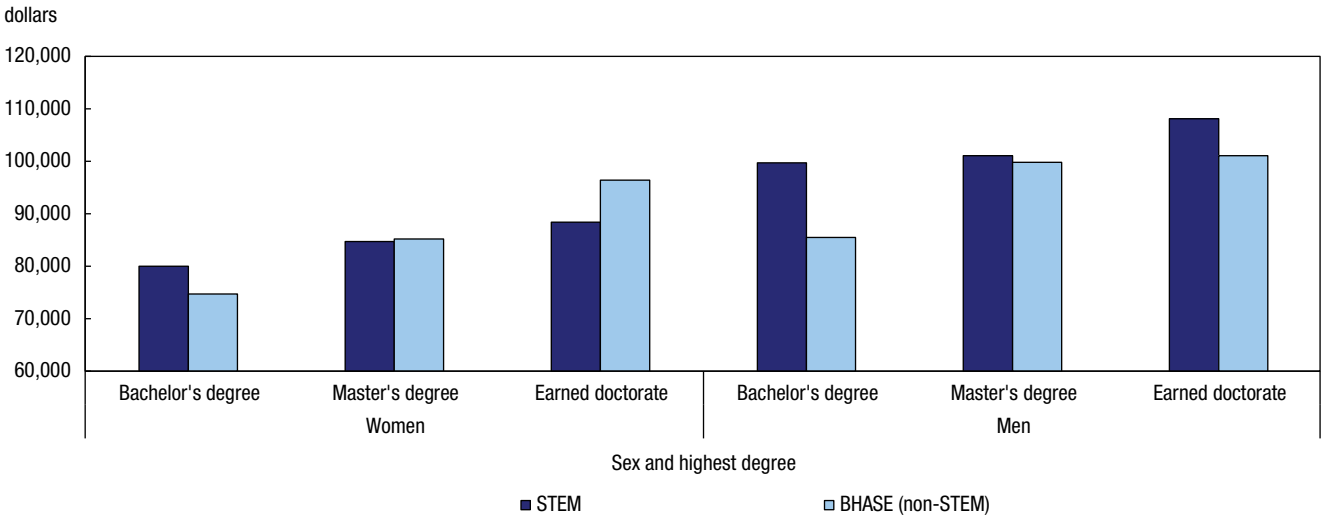
Among men, the situation was the opposite: the earnings advantage of having a doctorate over a master's degree was higher in STEM fields (7%) than in BHASE fields (1%); doctorate holders in STEM fields typically earned $108,100, compared with $101,100 for doctorate holders in BHASE fields.

In the 2010 National Graduates Survey, approximately one-half of people pursuing an earned doctorate reported that they were doing so in order to become a university professor.[17] Doctorate holders who were professors[18] typically had higher earnings than those who worked in other occupations. In BHASE fields, 45% of doctorate holders worked as university professors or lecturers, compared with 27% of STEM doctorate holders. STEM doctorate holders who were not professors, however, typically had other occupations closely related to their field of study. In the following sections, results are examined separately for each field within BHASE and STEM categories. The analysis begins by discussing results for BHASE fields.

In BHASE fields, the largest earnings difference between master's degree holders and bachelor's degree holders was in business and related studies

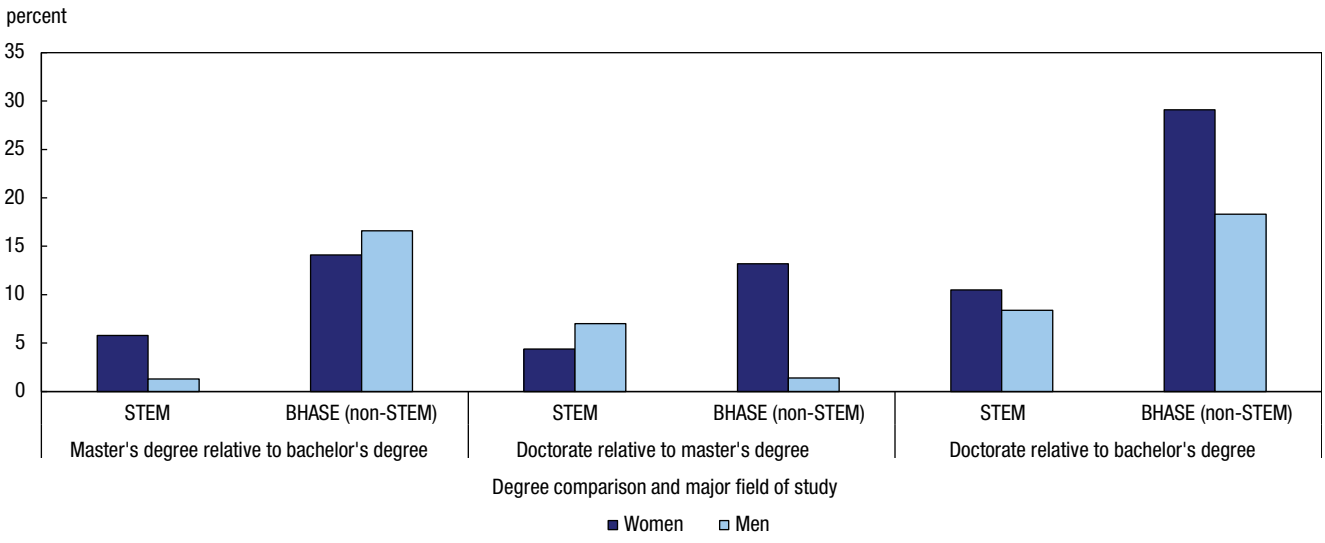
For most BHASE subfields, earnings were significantly higher for those with a master's degree relative to those with a bachelor's degree; the exceptions were women and men with a master's degree in law, and men with a master's degree in humanities or nursing (Table 3). The earnings advantage of having a doctorate over a bachelor's degree or a master's degree also appeared to be larger for women than for men, particularly in social and behavioural sciences, business and related studies, and law.

Chart 2
Difference in predicted median earnings between types of university degrees, women and men aged 30 to 59 who worked as full-year, full-time paid employees, 2015



Note: Numbers were rounded to the nearest 100.
Source: Statistics Canada, Census of Population, 2016.

Chart 3
Difference in predicted median earnings between types of university degrees, STEM and BHASE fields, women and men aged 30 to 59 who worked as full-year, full-time paid employees, 2015



Source: Statistics Canada, Census of Population, 2016.

Table 3
Difference in predicted median earnings between types of university degrees, BHASE fields, women and men aged 30 to 59 who worked as full-year, full-time paid employees, 2015

	Difference in predicted median earnings					
	Master's degree relative to bachelor's degree		Doctorate relative to master's degree		Doctorate relative to bachelor's degree	
	Men	Women	Men	Women	Men	Women
	percent					
All BHASE programs	**16.6****	**14.1****	**1.4**	**13.2****	**18.3****	**29.1****
Business and related studies	26.9**	27.9**	15.4**	25.7**	46.5**	60.8**
Public administration	17.8**	28.0**	F	F	F	F
Arts	9.6**	12.9**	-0.5	F	9.0†	F
Humanities	-4.1**	12.6**	20.3**	22.1**	15.4**	37.5**
Social and behavioural sciences	10.0**	18.5**	15.3**	20.5**	26.9**	42.7**
Law	0.0	2.9	2.7	12.5**	2.7	15.8**
Nursing	1.7	9.6**	F	16.6**	F	27.7**
Pharmacy and related programs	19.7**	17.8**	F	-6.6**	F	10.0**
Health care, n.e.c.	15.3**	8.0**	F	12.3**	F	21.2**
Education and teaching	15.1**	11.5**	13.4*	11.3**	30.5**	24.2**
Social work and related programs	7.5**	9.7**	F	32.7**	F	45.5**

F too unreliable to be published
* statistically different from zero ($p < 0.05$)
** statistically different from zero ($p < 0.01$)
† statistically different from zero ($p < 0.10$)
Source: Statistics Canada, Census of Population, 2016.

Business and related studies

Among full-year, full-time workers with a master's degree, the most common field of study was business and related studies, in large part because of the popularity of programs such as MBAs. Among those whose highest level of education was a master's degree, just under one-fifth (18%) of women and one-third (33%) of men had such a degree. Of these, nearly one-half (49%) specified that they held a master's of business administration (MBA).[19]

The earnings advantage of having a master's degree over a bachelor's degree in business and related studies was relatively large. Women and men with a master's degree in business and related studies earned 28% and 27% more, respectively, than those with a bachelor's degree in the same field.[20] This is consistent with other studies, which also found that the rate of return for a master's degree was highest in the commerce fields.[21]

Such results are partially due to changes in the occupational profile. Those with a master's degree in business and related studies were more likely to work as senior and specialized managers (38%) than those with a bachelor's degree in the same field (24%).[22] They also had higher earnings than bachelor's degree holders in these occupations; for example, among men, specialized managers with a bachelor's degree in business and related studies earned $108,000, while those with a master's degree earned $126,400.

Similar results were found for those who had a master's degree in public administration (MPA), with earnings advantages of 28% for women and 18% for men.[23] One-third of those with an MPA (33%) worked as senior or specialized managers, while another 28% worked as policy and program researchers, consultants and officers.

Social and behavioural sciences

In 2016, after business and related studies, education and teaching and social and behavioural sciences were the second and third most common fields of study at the master's degree level for the target population of this article. Both were more commonly studied by women than men: together, they made up about one third of master's degrees and doctorates among women. More particularly, social and behavioural sciences made up about one-quarter of doctorates among women; its psychology subfields alone accounted for 14% of women's doctorates.

Among women, those who had a master's degree in social and behavioural sciences earned 19% more than those with a bachelor's degree in the same field, and those with a doctorate earned 21% more than those with a master's degree. Among men, the differences were lower than for women, at 10% for a master's degree over a bachelor's degree, and 15% for a doctorate over a master's degree.[24]

These earnings differences are likely related to the fact that those graduating with a master's degree in social and behavioural sciences—which includes psychology and social sciences—are more likely to work in occupations related to their field of study.[25] At the bachelor's level, those in both the social science and psychology subfields were spread across a wide range of occupations, with 15% working in occupations that required a high school diploma or less. At the graduate level, however, 28% of those with a master's degree in social sciences worked as policy and program researchers, consultants and officers, while the majority of those with a doctorate worked as university professors and lecturers (56%). In the psychology subfield, one-quarter (26%) of those with a master's degree and 47% of those with a doctorate worked as psychologists.

Education and teaching

In education and teaching, men with a master's degree earned 15% more than those with a bachelor's degree, and men with a doctorate earned 13% more than those with a master's degree. Among women, the same percentages were 12% for a master's degree over a bachelor's degree, and 11% for a doctorate over a master's degree.

In contrast to the trend in social and behavioural sciences, graduate degree holders in education and teaching were less occupationally concentrated than bachelor's degree holders. While nearly 4 in 5 (79%) people with a bachelor's degree in education and teaching worked as elementary or secondary school teachers, a little over one-half (51%) of those with a master's degree and 15% of those with a doctorate in the field did so. Nearly one-fifth (19%) of those with a master's degree in education and teaching worked as school principals and superintendents,[26] an occupation with higher earnings ($109,000) than those of teachers with a master's degree ($85,800). Men with a master's degree in education and teaching were more likely to work as school principals and superintendents (28%) than women (15%). At the doctoral level, 43% of education and teaching degree holders worked as university professors and lecturers, who had median earnings of $106,400; another 12% worked either as school principals and superintendents or as managers in postsecondary education,[27] with median earnings of $124,000.

Previous studies found that graduate degrees increase the probability of working in a professional or managerial position, particularly in predominantly female fields of study,[28] and that occupation plays a large role in the increases in earnings associated with higher education generally.[29] The above findings indicate that occupation is related to the higher earnings associated with master's degrees and doctorates, but this relationship can take different forms. In social and behavioural sciences, the higher earnings associated with graduate degrees were partially because graduate degree holders were more likely than bachelor's degree holders to find work related to their field of study. In education and teaching, both bachelor's and graduate degree holders worked in occupations related to their field, but graduate degree holders had more upward mobility and were more likely to move into management positions such as school principal.

Humanities

Contrary to what was found in most other BHASE fields, men with a master's degree in the humanities earned less than men with a bachelor's degree in the same field. This is related to the fact that the subfield of theology and religious vocations accounted for more than one-third (38%) of master's degrees in the humanities among men, compared with 8% of bachelor's degrees in the humanities. Men with a master's degree in theology and religious occupations earned $63,000, while the earnings of men in other humanities subfields were $76,100 for those with a master's degree and $73,800 for those with a bachelor's degree.[30] A master's degree in theology and religious vocations is a common choice for people who intend to work as clergy: 6 in 10 (61%) men with a master's degree in this field worked in professional occupations in religion, which had relatively low earnings compared with other occupations requiring a university degree.

The effect of degrees in theology and religious vocations was less pronounced at the doctoral level, where they accounted for a smaller proportion (11%) of humanities degrees than at the master's level. Men with a doctorate in the humanities earned 15% more than those with a bachelor's degree in the humanities.

In contrast to men, women with a master's degree in humanities were less likely to have studied theology and religious vocations (17% did so) and had moderately higher earnings than their counterparts with a bachelor's degree (13%). Women with a doctorate in the humanities also earned significantly more than those with a bachelor's degree (38%); 54% worked as professors, with earnings of $103,000.

Other BHASE programs

Programs like law (LLB), pharmacy and related programs (such as BPharm) and nursing (such as BSc or BScN) are specialized degrees directed at giving their students the skills and qualifications for a specific occupation. Degrees in law and pharmacy, while classified as bachelor's degrees, may take longer than the four years needed for most undergraduate programs. These programs are among the highest-earning fields of study at the bachelor's level (with the exception of nursing among men), are relatively uncommon among graduate studies, and have high levels of occupational concentration.

In law and pharmacy and related programs, the occupational profile does not change much with a master's degree. The majority of law degree holders worked as lawyers[31] (55% among bachelor's degree holders, and 57% among master's degree holders) and the large majority of pharmacy and related program degree holders worked as pharmacists (88% among bachelor's degree holders and 75% among master's degree holders).

The earnings of master's degree holders in law were statistically equivalent to those of bachelor's degree holders in that program. However, in pharmacy and related programs, male and female master's degree holders earned almost 20% more than those with a bachelor's degree. This difference could be attributed to a difference in their place of work: pharmacists with a master's degree predominantly worked in hospitals (77%), while those with a bachelor's degree mainly worked in drug stores (76%).[32]

In nursing, women with a master's degree earned 10% more than those with a bachelor's degree. As with other BHASE fields, this was related to a change in occupational profile. While 80% of women with a bachelor's degree in nursing worked as registered nurses,[33] at the master's level fewer (38%) worked as registered nurses, and 25% worked as allied primary health practitioners (a category that includes nurse practitioners). Women who worked as registered nurses earned $83,200 with a bachelor's degree and $90,700 with a master's degree, while women with a master's degree who worked as allied primary health practitioners earned $101,400.

Little difference in earnings between master's degree holders and bachelor's degree holders in most STEM fields

Contrary to BHASE fields, there was little difference in the earnings of master's degree holders and bachelor's degree holders (less than 10%) in most STEM fields. In STEM, the occupational profile often didn't change with graduate studies, which may explain why there were fewer differences in earnings between master's degree holders and bachelor's degree holders. In most programs, however, those with a doctorate typically earned more than those with a master's degree in the same field (Table 4).

Engineering

In engineering, both men and women with a master's degree earned approximately the same as those with a bachelor's degree in the field. This is likely because there was little change in occupation associated with a master's degree:

Table 4
Difference in predicted median earnings between types of university degrees, STEM fields, women and men aged 30 to 59 who worked as full-year, full-time paid employees, 2015

	Difference in predicted median earnings					
	Master's degree relative to bachelor's degree		Doctorate relative to master's degree		Doctorate relative to bachelor's degree	
	Men	Women	Men	Women	Men	Women
	percent					
All STEM programs	**1.3****	**5.8****	**7.0****	**4.4****	**8.4****	**10.5****
Physical and chemical sciences	1.9†	7.5**	12.0**	5.4*	14.2**	13.3**
Biological sciences	4.1**	7.8**	14.5**	9.9**	19.2**	18.4**
General and integrated sciences	2.0	9.4**	F	F	F	F
Engineering	0.7	0.4	7.0**	1.3	7.8**	1.8
Mathematics and related studies	7.5**	4.6*	5.7†	F	13.6**	F
Computer and information science	6.4**	0.1	13.8**	13.2**	21.1**	13.3*

F too unreliable to be published
* statistically different from zero ($p < 0.05$)
** statistically different from zero ($p < 0.01$)
† statistically different from zero ($p < 0.10$)
Source: Statistics Canada, Census of Population, 2016.

47% of those with a bachelor's degree in engineering worked as engineers,[34] as did 51% of those with a master's degree. Engineers with a master's degree earned $105,100, essentially the same as engineers with a bachelor's degree ($105,200).

At the doctoral level, women with a doctorate in engineering had earnings that were statistically equivalent to the earnings of those with a bachelor's degree in the field, while men earned 8% more than those with a bachelor's degree. More than one-third (37%) of doctorate degree holders in engineering worked as engineers and earned only slightly more ($108,500) than engineers with a master's or bachelor's degree; one-quarter (25%) worked as university professors and had earnings of $127,700.

These findings raise the question as to why degrees in engineering are common at the graduate level. Among men, they account for 15% of master's degrees and 23% of doctorates. A possible explanation could be that immigrants made up the majority (50%) of people who completed their engineering master's degree in Canada, while nearly two-thirds (65%) of them completed an engineering doctorate in Canada. The high educational attainment of immigrants to Canada is well-documented, as are the challenges faced by immigrants with educational credentials from outside Canada.[35]

It is likely that immigrants with a degree in engineering from outside Canada will complete a graduate degree in engineering after arriving in Canada in order to earn Canadian educational credentials that are recognized by employers.[36] Both immigrants and non-immigrants might also complete graduate degrees in engineering in order to conduct more in-depth research on a specific topic, or to obtain the skills and knowledge necessary to work on a specific project.

Biological sciences and physical and chemical sciences

Women with a master's degree in biological sciences and physical and chemical sciences earned 8% more than those who had a bachelor's degree in the same field; among men, the same figure was lower, at 4% for biological sciences and less than 2% for physical and chemical sciences. At the doctoral level, men earned more than their counterparts with a master's degree by a margin of 12% to 15%; among women, the same percentages were 5% for those in biological sciences and 10% for those in physical and chemical sciences.

When the earnings of doctorate holders were compared with those of bachelor's degree holders, the results were similar for women and men. In biological sciences, earnings were 18% higher for women and 19% higher for men with a doctorate; in physical and chemical sciences, earnings were 13% higher for women and 14% higher for men with a doctorate.

Despite these results, biological sciences and physical and chemical sciences were among the lowest-paying fields among women with a doctorate. The proportion of women with doctorates who worked as professors was 26% in biological sciences and 22% in physical and chemical sciences, lower than in most other fields; they had earnings of $106,500. Those who were not professors typically had occupations related to their fields of study, but with lower pay than professors, for example, biologists ($83,100) and chemists ($86,100). In addition, 8% worked as postsecondary teaching or research assistants, who earned $54,500.

Computer and information science

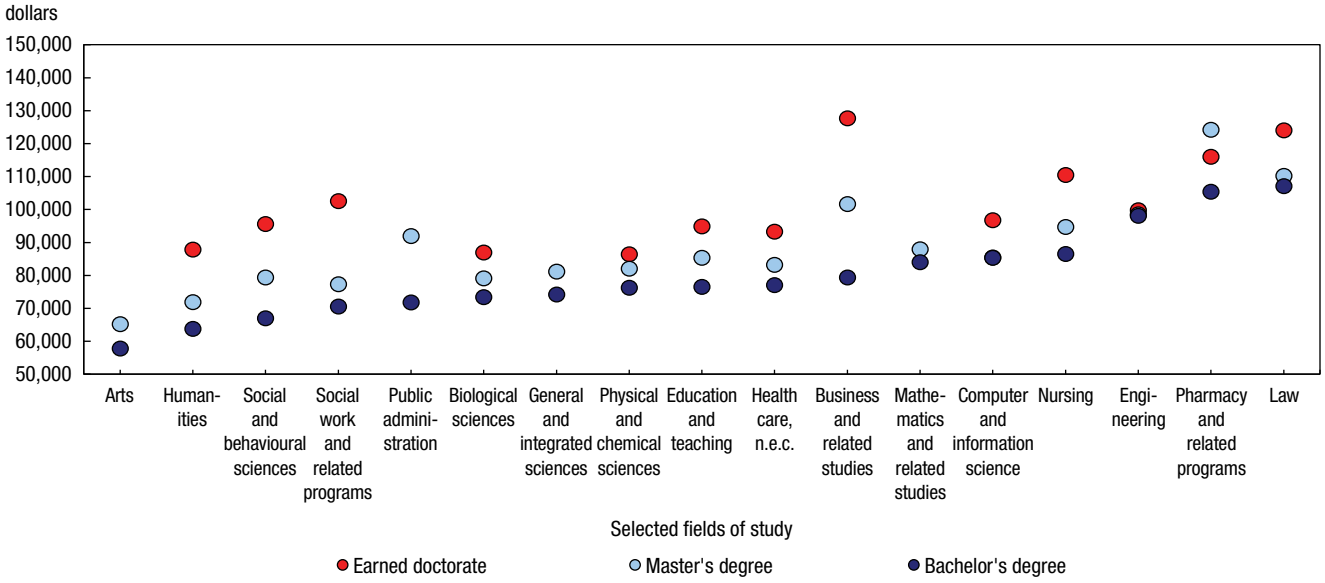
In computer and information science, as in engineering, there was little earnings difference between bachelor's and master's degree holders, and little occupational change between them. Women with a master's degree in computer and information science earned approximately the same as those with a bachelor's degree, while men earned 6% more with a master's degree than a bachelor's degree. In terms of occupation, 54% of bachelor's degree holders and 48% of master's degree holders in computer and information science worked as computer and information systems professionals.

However, doctorate holders in computer and information science earned more than master's degree holders, by 13% for women and 14% for men. This was mainly because 34% of doctorate holders in computer and information science worked as university professors and typically earned $130,000, while master's degree holders who worked as computer and information systems professionals typically earned $90,300.

Master's degree and doctorate holders in business and related fields had higher earnings than doctorate holders in most other fields

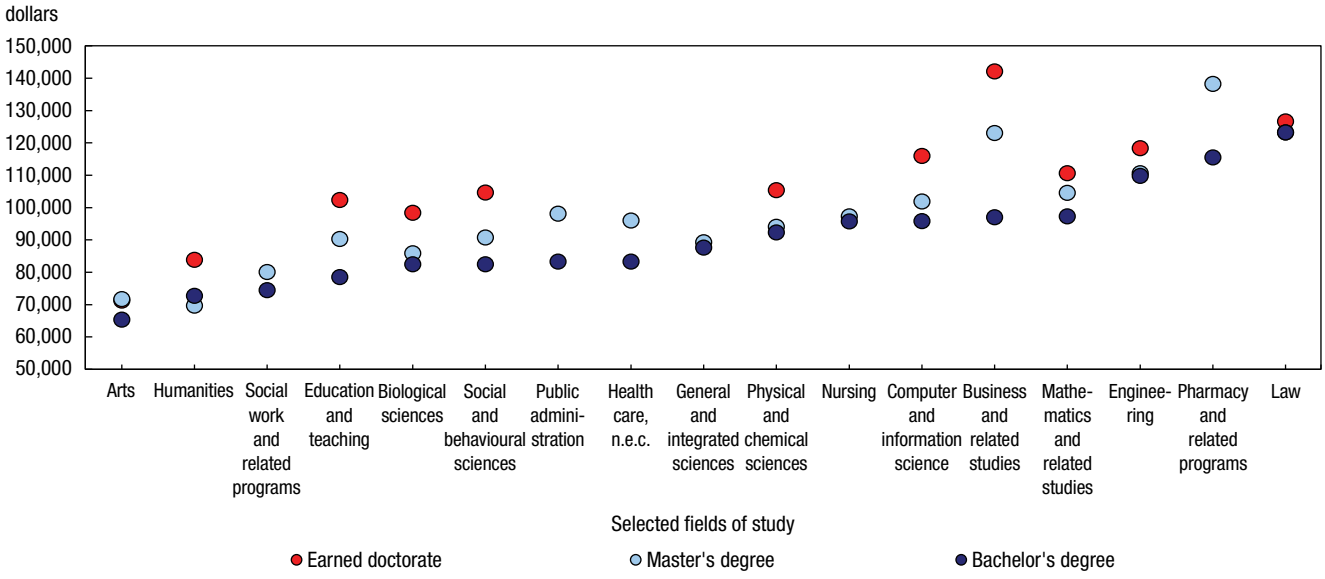
Charts 4a and 4b provide a visual representation of the earnings of full-year, full-time employees in each field of study by sex and by level of education. For both men and women, the highest-earning master's degrees were in the fields

Chart 4a
Predicted median earnings of women aged 30 to 59 who worked as full-year, full-time paid employees, by highest degree and selected fields of study, 2015



Note: Numbers were rounded to the nearest 100.
Source: Statistics Canada, Census of Population, 2016.

Chart 4b
Predicted median earnings of men aged 30 to 59 who worked as full-year, full-time paid employees, by highest degree and selected fields of study, 2015



Note: Numbers were rounded to the nearest 100.
Source: Statistics Canada, Census of Population, 2016.

of business and related studies, law, and pharmacy and related programs. However, while law and pharmacy and related programs were also the highest-earning fields at the bachelor's degree level, business and related studies had earnings closer to the middle at the bachelor's level.

Master's degree holders in business and related studies not only had higher earnings than most other master's degree holders, they also had higher earnings than doctorate holders in many fields of study. Men with a master's degree in business and related studies had higher earnings than men with a doctorate in any other field of study besides law. Women with a master's degree in business and related studies had higher earnings than women with a doctorate in sciences,[37] social and behavioural sciences, humanities, or education and teaching. Other studies also have found that business-related fields were among the highest-earning fields for both men and women.[38]

Graduates of business and related studies also had among the highest earnings at the doctoral level. Men with a doctorate in business and related studies earned $142,100, more than those with any other degree. Women with a doctorate in business and related studies earned $127,700, comparable to women with a doctorate in law and more than women with a doctorate in any other field of study. Approximately two-thirds (67%) of people with a doctorate in business and related studies worked as university professors and lecturers.

That said, master's degree holders in business and related studies were more likely than doctorate holders in the same field to be among the highest-earning Canadians. About 1 in 7 (15%) people with a master's degree in business and related studies were in the top 1% of Canadians in terms of earnings, compared with 8% for those with a doctorate in the field. This was primarily due to the high proportion of master's degree holders in business and related studies who worked in senior management occupations: 11%, compared with 2% of their counterparts with a doctorate, and 3% of those with a graduate degree in other fields of study.

Conclusion

The earnings advantage associated with pursuing a master's degree or a doctorate is different for each field of study. Generally speaking, in BHASE fields (such as business and related studies), workers who have a master's degree earn significantly more than those with a bachelor's degree, likely because those with a master's degree are more likely to work in occupations that are more closely aligned with their field of study. However, not all BHASE fields of study followed this trend. In law, bachelor's and master's degree holders had similar occupational profiles, and therefore the earnings advantage of having a master's degree was comparatively smaller. In pharmacy and related programs, those with a master's degree had a relatively large earnings advantage over those with a bachelor's degree, despite bachelor's and master's degree holders having similar occupations; in this case, the earnings difference was related to a difference in the location of work.

In most STEM programs, the earnings advantage associated with a master's degree is comparatively smaller. In all STEM fields, the earnings advantage of having a master's degree over a bachelor's degree was less than 10%. This is because graduate degree holders in STEM fields, such as engineering, have occupations similar to those of bachelor degree holders.

In STEM fields, having a doctorate seems to have more of an impact on men's earnings, while in BHASE fields, the earnings advantage of having a doctorate over a master's degree seems more pronounced for women. Given that many doctorate holders work as university professors and lecturers—particularly in BHASE fields—it is possible that these changes are attributable to gender differences in the occupational profile of doctorate holders. More research is needed to understand these differences.

In general, the results outlined above indicate that, in most fields of study, the earnings differences between graduate degree holders and bachelor's degree holders are related to the fact that graduate degree holders are able to obtain work in higher-paying occupations than bachelor's degree holders.

One avenue for further analysis is a more systematic examination of the relationship between earnings differences and occupation for

graduate degree holders. There are numerous possible relationships: graduate degrees may result in higher earnings by increasing the ability of graduates to find work in occupations relevant to their field of study; by increasing their ability to obtain management positions; or by enabling them to be more productive while working in the same occupations as bachelor's degree holders. In addition, individuals who complete graduate programs may also have higher levels of skills, abilities, and attributes (such as motivation or ambition) than bachelor's degree holders, which may contribute to higher earnings.

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Data sources, methods and definitions

Data sources

The data in this analysis are from the 2016 Census of Population. The target population is Canadians aged 30 to 59 (excluding non-permanent residents) who had a bachelor's degree, master's degree or earned doctorate as their highest level of education; obtained that degree in Canada; worked as full-year, full-time employees in 2015; and had positive wages. While 7% of the target population had some amount of self-employment income, less than 3% had losses or gains of more than $5,000. Degrees in medicine, dentistry, veterinary medicine and optometry are not included, as these degree types are distinct from bachelor's and master's degrees and doctorates.

This target population is similar to the one used in the Census in Brief article "Is field of study a factor in the earnings of young bachelor's degree holders?"[39] It differs in three main ways: it includes master's and doctoral degree holders, while the previous article did not include them; its age range is from 30 to 59, while the previous paper looked at young people aged 25 to 34; and it includes the fields of law, and pharmacy and related programs, whereas the previous article excluded them because these degrees require previous postsecondary education prior to entry, and thus are not strictly comparable to other bachelor's degrees. The greater age range is used because graduate degrees take longer to complete than bachelor's degrees; it also allows sufficient sample size for analytically valid results, particularly at the doctoral level.

Data are suppressed for degrees where the median earnings (raw, not regression-adjusted) have a coefficient of variation greater than 0.05; in most cases, these are degrees that have an unweighted sample size of less than 100 people.

Methods

Predicted earnings were obtained using a quantile regression, which controlled for factors that could influence earnings, in order to more accurately make comparisons between fields of study and levels of education. The dependent variable was median earnings; the independent variables were age and age squared (as continuous variables) and educational attainment, major field of study, geography, family status, immigrant status, and visible minority status (all as categorical variables). Controlling for immigrant status is of particular importance because immigrants tend to have lower earnings than non-immigrants, but they are more likely than non-immigrants to have graduate degrees and study in STEM fields.

In this article, earning levels by field of study (in charts 2, 4a and 4b) were produced using regression analysis. However, dollar figures that indicate the earnings associated with an occupation are descriptive results (and are not regression-adjusted). All dollar figures cited in the text of the article are rounded to the nearest hundred dollars.

Definitions

Full-year, full-time work is defined as working for at least 49 weeks and 30 hours or more per week during the year preceding the census (in 2015).

Earnings are defined as wages, salaries and commissions obtained during the year preceding the census (in 2015).

Field of study is based on the 2016 Classification of Instructional Programs (CIP), and specifically its science, technology, engineering and mathematics (STEM) and BHASE (non-STEM) groupings. BHASE fields include, but are not limited to, business, health, humanities, arts, social sciences, and education.

Supplementary information

Table A1
Percentage of doctorate holders who worked as university professors, out of people aged 30 to 59 who worked as full-year, full-time paid employees, 2016

	percent
All fields of study	**34.9**
STEM	**27.3**
Science and science technology	**26.9**
Physical and chemical sciences	23.1
Biological sciences	28.8
General and integrated sciences	29.9
Engineering and engineering technology	**24.8**
Engineering	24.9
Mathematics and computer and information science	**38.1**
Mathematics and related studies	41.7
Computer and information science	34.2
BHASE (non-STEM)	**45.3**
Business and administration	**66.5**
Business and related studies	66.9
Public administration	26.9
Arts and humanities	**51.3**
Arts	48.7
Humanities	51.6
Social and behavioural sciences	**43.1**
Legal professions and studies	**21.6**
Law	21.6
Health care	**41.1**
Nursing	65.0
Pharmacy and related programs	12.4
Health care, n.e.c.	41.0
Education and teaching	**43.3**
Trades, services, natural resources and conservation	**39.6**
Agriculture and natural resources operations and management	19.3
Mechanics and repair, architecture, construction and precision production[1]	32.0
Social work and related programs	66.0
BHASE (non-STEM) programs, n.e.c[2]	59.2

1. At the university level, the most common field of study in this category is architecture and related services.
2. This category is made up of selected subfields of parks, recreation, leisure and fitness studies, along with library science, and multidisciplinary/interdisciplinary studies, other.

Source: Statistics Canada, Census of Population, 2016.

Notes

1. See the following Census of Population 2016 education highlight table: *Highest level of educational attainment (detailed) by selected age groups 25 to 64, both sexes, % distribution 2016, Canada, provinces and territories, 2016 Census.*
2. Also known as the quaternary sector. See Finnie and Frenette (2003) and Walters (2004).
3. See Ostrovsky and Frenette (2014); Frank and Walters (2012); Statistics Canada (2017); Finnie and Frenette (2003); Walters (2004).
4. See Heisz (2001).
5. See Stark (2007); Kim et al. (2015); Frenette and Frank (2016).
6. See Frenette and Frank (2016).
7. While students can pursue a master's degree or doctorate in a different field than their bachelor's degree, this study does not make such comparisons.
8. While Stark (2007) provides a detailed examination of the rates of return associated with master's and doctorate degrees, he uses the 1996 Census, so more recent data on the subject are of value.
9. See *Classification of Instructional Programs (CIP) Canada 2016 – Variant of CIP 2016 – STEM and BHASE groupings* (http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=401856), Statistics Canada.
10. See, for example, Council of Canadian Academies (2015).
11. This age range is used to account for graduate degrees taking longer to complete than bachelor's degrees, and to allow sufficient sample size for analytically valid results, particularly at the doctoral level.
12. This includes only the instructional program classes included in CIP category 42. Psychology that are included in social and behavioural sciences in the STEM/BHASE categorization. It does not include the classes of 42. Psychology that are included in biological sciences, whose subfields made up less than 1% of women's doctorates.
13. See Stark (2007); Lemieux (2014). This refers to the returns from a bachelor's degree (relative to high school), a master's degree (relative to a bachelor's degree) and a doctorate (relative to a master's degree).
14. See Stark (2007); Tamburri (2013).
15. To a large extent, the differences in earnings between BHASE and STEM at the bachelor's level are due to the fact that those with a bachelor's degree in STEM are more likely to work in occupations closely related to their field of study.
16. This is consistent with the findings of Stark (2007), in which the returns to a master's degree were higher in non-science fields than in science fields, even though this study uses a different field of study classification than the one used in this article.
17. See Ferguson (2016). Less than 15% of doctoral graduates found employment as professors within three years of graduation, based on the 2013 National Graduates Survey (Etmanski et al. 2017).
18. Throughout this article, "professors" and "university professors" refers to National Occupational Classification (NOC) 2016 code 4011 (University professors and lecturers). See Table A1 in the Appendix for the proportion of doctorate holders who worked as university professors.
19. Within business and related studies, additional people with MBAs may have described their field of study in other ways (for example, as business rather than an MBA specifically) and therefore have not been included in this percentage.
20. The only other field with an earnings advantage of more than 20% for a master's degree over a bachelor's degree was public administration among women. However, public administration is rarely studied at the bachelor's degree level.
21. See Stark (2007).
22. Senior managers refers to National Occupational Classification (NOC) 2016 code 00 (Senior management occupations), and specialized managers refers to code 01-05 (Specialized middle management occupations).
23. Bachelor's degrees in public administration are relatively rare, indicating that most people with a master's in public administration had a bachelor's degree in another subject.
24. This contrasts with Kim et al. (2015), who found low financial returns to graduate degrees in the social sciences. However, that article differed from this one in that it focused on the United States rather than Canada, looked at lifetime returns rather than annual wages, and used a different field of study classification.

25. This section only covers the instructional program classes of CIP categories 42. Psychology and 45. Social sciences that are included in social and behavioural sciences in the STEM/BHASE categorization. Classes of 42. Psychology and 45. Social sciences, which fall under other STEM/BHASE categories, are excluded.
26. Refers to National Occupational Classification (NOC) 2016 code 0422 (School principals and administrators of elementary and secondary education).
27. Refers to National Occupational Classification (NOC) code 0421 (Administrators – post-secondary education and vocational training).
28. See Roksa (2005).
29. See Lemieux (2014).
30. This is consistent with Frenette and Frank (2016), who found that theological and ministerial studies (a subseries of theology and religious vocations) was the lowest-earning field of study at the master's level for men.
31. Refers to National Occupational Classification (NOC) 2016 code 4112 (Lawyers and Quebec notaries).
32. Drug stores refers to NAICS 2012 code 446 (Health and personal care stores).
33. Refers to National Occupational Classification (NOC) 2016 code 3012 (Registered nurses and registered psychiatric nurses).
34. Refers to National Occupational Classification (NOC) 2016 codes 213 (Civil, mechanical, electrical and chemical engineers) and 214 (Other engineers).
35. See Ewoudou (2011).
36. The quantile regression does not compare the earnings of degrees from outside Canada to those of graduate degrees from earned in Canada, since its target population is restricted to those with Canadian credentials.
37. Sciences refers to biological sciences, physical and chemical sciences and general and integrated sciences.
38. See Frenette and Frank (2016). The four specific business fields where they found the highest earnings were finance and financial management services; business/commerce, general; business administration, management and operations; and accounting and related services. In that study, however, law and pharmacy degrees are classified as professional degrees and are therefore excluded from the analysis.
39. See Statistics Canada (2017).

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