

Economic Insights

Which Bachelor's Degree Programs Were Associated with the Highest Pay Prior to the COVID-19 Pandemic? A Focus on Very Detailed Fields of Study

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Which Bachelor's Degree Programs Were Associated with the Highest Pay Prior to the COVID-19 Pandemic? A Focus on Very Detailed Fields of Study

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Most studies reporting earnings by field of study report results by broad grouping (e.g. engineering or humanities). However, students must select more specific programs, not broad groupings of programs. Combining postsecondary administrative and taxation data, this study is the first of three that reports on the median earnings of degree graduates five years after graduation (prior to the COVID-19 pandemic), after adjusting for age, institution, and year of graduation. Results are shown for 118 fields for men and for 123 fields for women, all at the bachelor's degree level. The key findings are that graduates of various types of engineering programs generally rank at or near the top in terms of median earnings. Pharmacy graduates and graduates of most technical disciplines also performed well. In general, graduates near the top of the list earned multiple times more than those at the bottom (two to three times more for men, and two to five times more for women). Female and male graduates of female-dominated disciplines registered a diverse range of median earnings, while those of male-dominated disciplines largely registered relatively high median earnings. The study also highlights the fact that reporting labour market outcomes by broad discipline classification (e.g. science) can be very misleading, as outcomes often vary considerably among more specific disciplines. Given the divergent outcomes by detailed fields of study that are most often grouped together in related literature, future work in the area may benefit by reporting earnings for the most detailed fields of study possible in the available data.

Introduction

While it is well-known that graduates of certain faculties (e.g. engineering) earn more than other graduates (e.g. humanities), students may benefit from more detailed information since they must select more specific disciplines (e.g. Petroleum engineering or Materials engineering). This is particularly important since the expected earnings associated with a discipline is an important factor in the decision of students (Gunderson and Krashinsky, 2009). The purpose of this study is to provide earnings estimates of graduates of specific disciplines for a very wide range of bachelor's degree graduates.

The study focuses on bachelor's degree graduates from universities and colleges between the years 2010 and 2012 from the Postsecondary Student Information System (PSIS).¹ The PSIS contains

1. This is one of three articles examining the earnings of graduates by detailed fields of study. The other articles look at master's graduates (Frenette and Handler 2020a) and doctoral graduates (Frenette and Handler 2020b). Future work may look at college certificate and diploma graduates, as more data become available. Note that the data used in these studies were collected and the first drafts written prior to the COVID-19 pandemic. How individuals who graduate from specific programs during or after the pandemic will fare in the labour market may not be known for quite some time.

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information on virtually all graduates, which facilitates a detailed breakdown of disciplines.² The median paid earnings³ (T4 wages and salaries) of graduates are observed five years later (e.g. in 2017 for the 2012 graduating class) from the T1 Family File (T1FF) for individuals who did not pursue postsecondary schooling in the five years following graduation and did not report self-employment income five years after graduation.⁴ In all cases, results pertain to the period prior to the COVID-19 pandemic. Importantly, individuals with zero earnings are included in this study.⁵ Median earnings are reported in 2017 constant dollars (from Table 18-10-005-01) and are adjusted for differences in age, institution, and year of graduation across fields of study through quantile (median) regression.⁶ Results are reported by the four-digit 2011 Classification of Instructional Program (CIP), separately by sex, for fields with at least 50 observations. In total, results for 118 (123) fields are reported for men (women).^{7,8,9}

Previously, Frenette and Frank (2016) reported earnings by detailed fields of study based on the 2011 National Household Survey (NHS), which was the only data source available to conduct such a study at that time.¹⁰ Although the NHS allowed the authors to focus on full-year, full-time workers, which provides

2. Many recent studies of the earnings of bachelor's degree graduates by field of study have been based on the Census or the National Household Survey (NHS), either in combination with tax data (Ostrovsky and Frenette 2014; Frank, Frenette, and Morissette 2015; Frenette 2019) or without tax data (Zhao et al. 2017). Some research has been based on the National Graduates Survey (NGS), such as Frank and Walters (2012). However, these data sources are based on random samples, which limit the ability to provide very detailed breakdowns. Frenette and Frank (2016) were able to report results by detailed fields of study, but to do so, the study had to include all graduates between the ages of 25 and 54, regardless of when they completed their program. Galarneau et al. (2017) and Finnie et al. (2019) both use the PSIS data to study earnings by field of study, but results are only shown by broad category.
3. Mean, or average earnings can be influenced by outlier values, which can affect results when sample sizes are relatively small. For this reason, median earnings (the earnings of the individual in the middle of the distribution) are preferred.
4. Post-graduation enrolment is determined jointly from PSIS enrolment and graduation data during the first four years following graduation, as well as T1FF data for all five years following graduation (via Tax Credits and Education and Textbook Amounts – see Frenette, 2017 for a discussion of this approach). The 2017 PSIS data are not yet available in the PSIS-T1FF linkage, and thus, it is not possible to observe enrolment or graduation data for 2012 graduates, five years later.
5. As such, this approach will capture negative employment effects associated with certain disciplines. This approach is in line with experimental methods that do not select samples based on any outcomes (such as earnings). Results were qualitatively similar when the samples were further restricted to individuals earnings at least \$1,000 (results available upon request). Note that the study excludes anyone reporting self-employment income due to the inherent difficulties in comparing paid and self-employed workers (see LaRochelle-Côté and Uppal 2011).
6. In all cases, adjusted median earnings were estimated by predicting median earnings for each individual in the sample, based on the values of their covariates and assigning each of them the same field of study, and then taking the average of these predicted medians across the entire sample. This process is repeated for each discipline examined in the study, resulting in predicted median earnings that can be compared across disciplines based on the same value of covariates in each case (i.e. the average for the entire sample).
7. Although the statistical significance of the results is reported in this study, it is important to note that there is no sampling in the data used in deriving the results other than the sampling restrictions. In other words, results are based on complete, well-defined populations (e.g. all female graduates of a certain discipline who appeared in the tax data). Statistical significance can be used by readers to make inferences to “super-populations” (e.g. all female graduates of a certain discipline, whether they appeared in tax data or not). However, in doing so, it is important to note that the “sampling” process (appearing in the tax data) was not necessarily random, and no weights have been created to obtain estimates for the larger population.
8. Note that the following professional programs were excluded from the analysis since they are typically not offered as a first degree after high school (like most bachelor's degree programs): Law (LLB, JD, BCL), Legal research and advanced professional studies (post-LLB/JD), Chiropractic (DC), Dentistry (DDS, DMD), Advanced/graduate dentistry and oral sciences (Cert., MS, MSc, PhD), Medicine (MD), Optometry (OD), Osteopathic medicine/osteopathy (DO), Podiatric medicine/podiatry (DPM), Veterinary medicine (DVM), Dental residency programs, Veterinary residency programs, Medical residency programs—general certificates, Medical residency programs—subspecialty certificates, Podiatric medicine residency programs, and Dental, medical and veterinary residency programs (other).
9. Disciplines with fewer than 50 observations are included when reporting results for all bachelor's degree graduates, which consist of 64,259 men and 87,744 women. The percentage of these graduates in disciplines with fewer than 50 observations is 3.1% for men and 2.1% for women.
10. Stark (2007) estimated the rates of returns associated with detailed fields of study by level of education based on the 1996 Census. In total, results for 42 detailed fields were reported at the bachelor's degree level.

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an interesting comparison across disciplines, the sample is smaller than in PSIS. In fact, only 61 and 69 fields could be reported for male and female bachelor's degree graduates, respectively. Moreover, to obtain a large enough sample, the authors also had to include all workers between the ages of 25 and 54—many of whom graduated decades earlier. The current study builds on this work by reporting results for recent graduates in almost twice as many fields.

Most top earners are engineering graduates with various specialties

Most top-earning graduates came from various engineering specialties. In fact, 6 of the top 10 disciplines among men (Chart 1), and 7 of the top 10 disciplines among women consisted of various types of engineering specialties (Chart 2). For example, Mining and Mineral Engineering graduates ranked first among men with \$111,533 in adjusted¹¹ median earnings five years after graduation, and second among women with \$89,680.¹² Chemical engineering also ranked high, landing 5th among male graduates (\$89,637) and 3rd among female graduates (\$82,193). In total, there were 23 different types of engineering disciplines among men, all of which appeared in the top 44 of the 118 disciplines. Due to smaller samples, only 9 types of engineering graduates appeared on the list for women, and all were in the top 15 according to median earnings.

Recent advances in artificial intelligence and automation may exert upward pressure on the wages of workers involved in developing the new technology. However, male graduates of Mechatronics, robotics, and automation engineering ranked 19th among the 21 engineering disciplines for men. Engineering fields associated with natural resource extraction earned more, including graduates from Mining and mineral engineering, Petroleum engineering, and Geological/geophysical engineering.

The findings also point to important differences among fields that are typically grouped together in aggregate analyses. For example, the CIP primary groupings combine engineering and architecture graduates. However, male graduates of Architecture and related services (other) earned less than the median male bachelor's degree graduate, and well below all 23 types of engineering graduates. Women in Architecture and related services (other) also earned less than their counterparts who took any of the 9 engineering programs, but slightly above the median for all female bachelor's degree graduates.

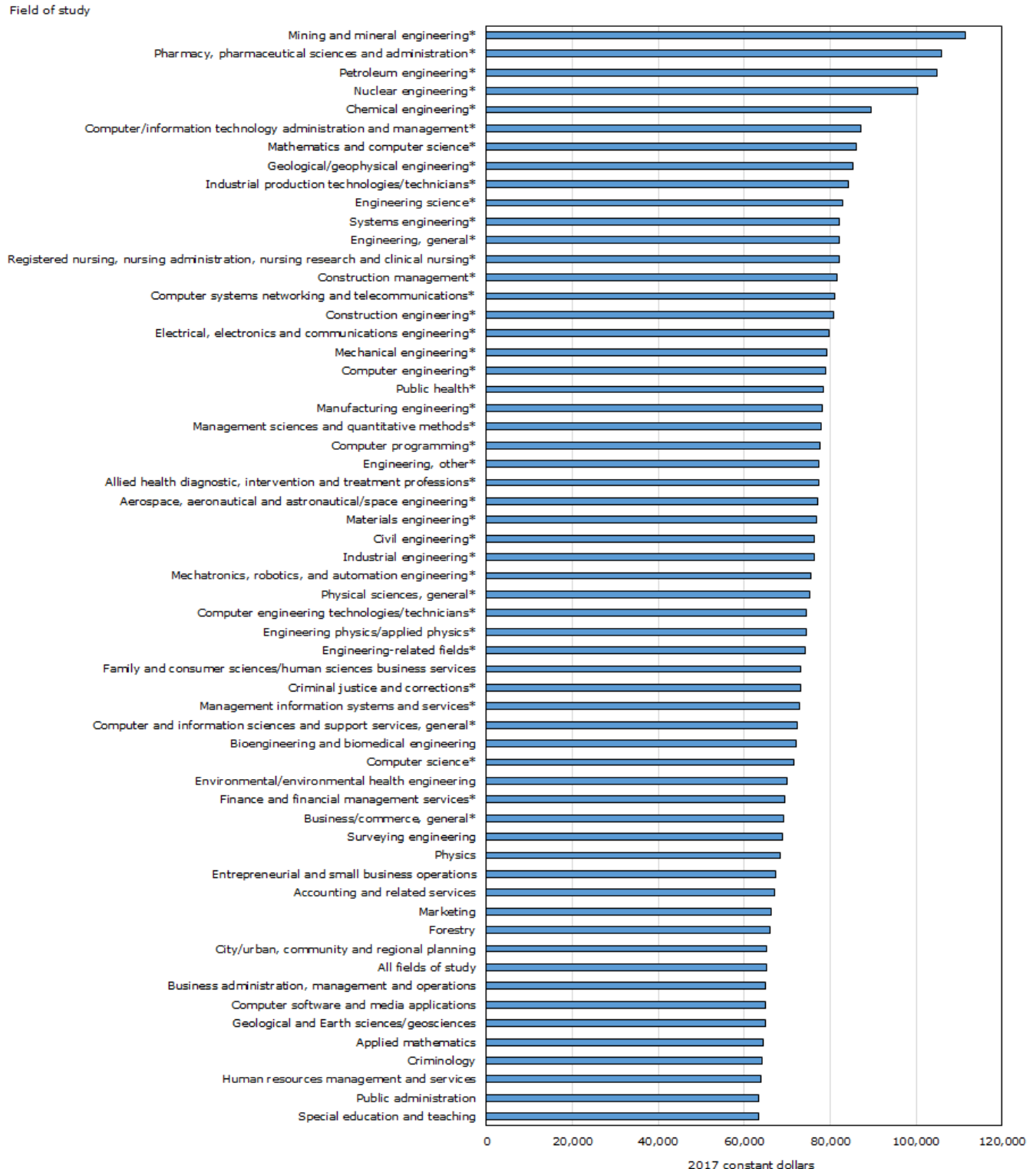
Graduates from other disciplines also ranked among the top earners. For example, male and female Pharmacy, pharmaceutical sciences and administration graduates registered the second highest median earnings among men with \$106,055, and the highest median earnings among women with \$94,177. Male graduates of Computer/information technology administration and management and Mathematics and computer science, as well as female graduates of Registered nursing, nursing administration, nursing research and clinical nursing and Management sciences and quantitative methods also landed in the top 10.

11. Only median earnings, adjusted for age, institution, and graduation cohort are reported in this study. Results based on unadjusted median earnings are qualitatively similar and are available upon request.

12. The data used in this study is not ideal for comparing earnings of men and women as it does not contain information on hours or weeks of work, as well as industry or occupation. As result, the study does not compare the dollar value of earnings of men and women. Instead, the focus is placed on the relative rankings of each discipline for men and women.

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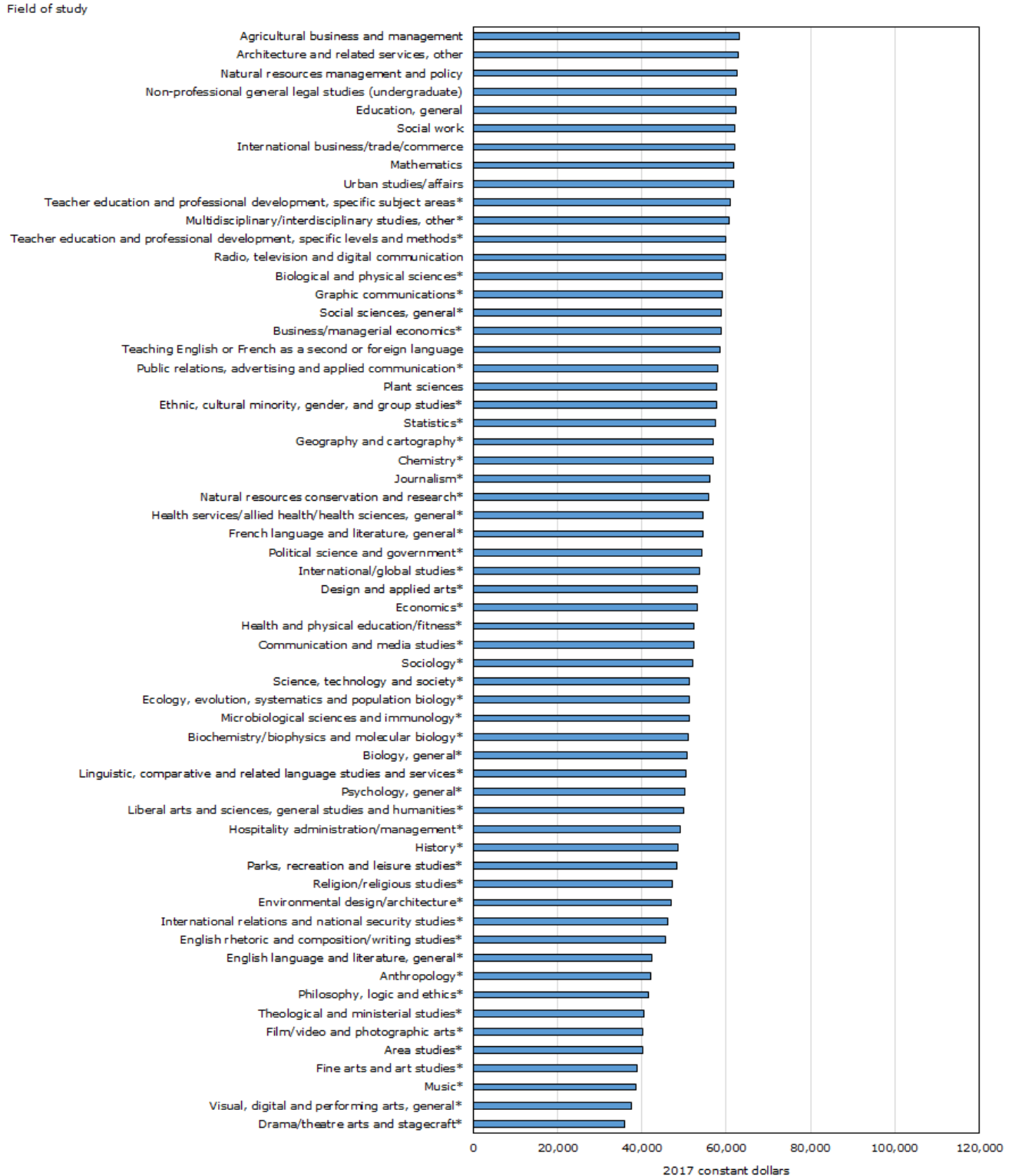
Chart 1-1
Median earnings of male bachelor's degree graduates by field of study (adjusted for age, institution, and graduation year) – Part 1



*significantly different than all fields of study combined ($p < 0.05$)
Sources: Statistics Canada, Postsecondary Student Information System (PSIS) and T1 Family File (T1FF).

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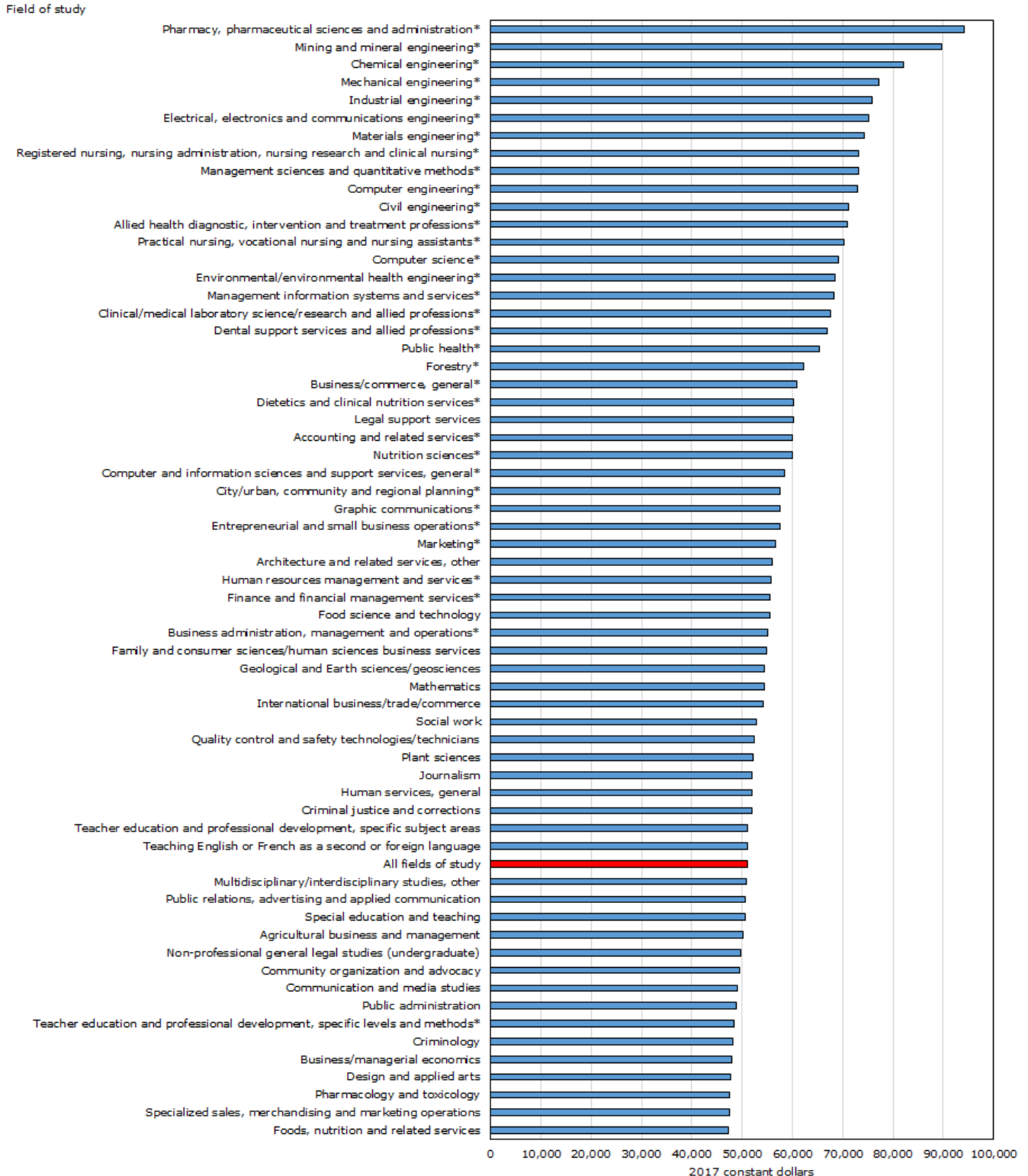
Chart 1-2
Median earnings of male bachelor's degree graduates by field of study (adjusted for age, institution, and graduation year) — Part 2



*significantly different than all fields of study combined ($p < 0.05$)
Sources: Statistics Canada, Postsecondary Student Information System (PSIS) and T1 Family File (T1FF).

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Chart 2-1
Median earnings of female bachelor's degree graduates by field of study (adjusted for age, institution, and graduation year) — Part 1

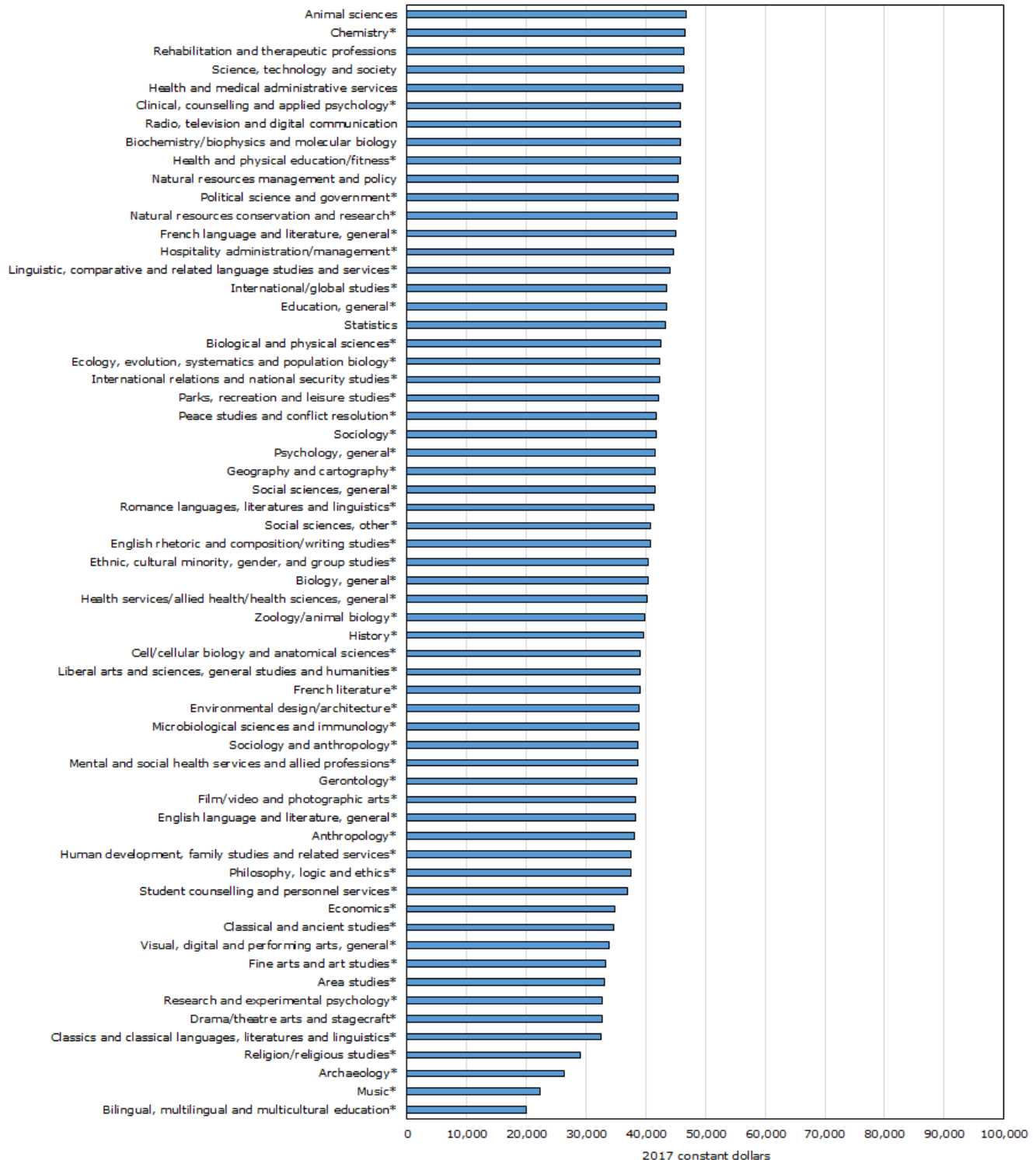


*significantly different than all fields of study combined (p < 0.05)
 Sources: Statistics Canada, Postsecondary Student Information System (PSIS) and T1 Family File (T1FF).

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Chart 2-2
Median earnings of female bachelor's degree graduates by field of study (adjusted for age, institution, and graduation year) — Part 2

Field of study



*significantly different than all fields of study combined ($p < 0.05$)
 Sources: Statistics Canada, Postsecondary Student Information System (PSIS) and T1 Family File (T1FF).

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Graduates from certain programs earned multiple times more than others

Graduates in the top 10 fields generally earned multiple times more than those at the bottom. For men, median earnings ranged from \$82,877 and \$111,533 among disciplines in the top 10, which was generally about two to three times more than the range at the bottom (\$42,298 and \$35,935). For women, the disparity was even larger—\$72,911 and \$94,177 at the top, about two to five times more than at the bottom (\$33,765 to \$19,892).

Most of the disciplines associated with the lowest median earnings were in arts or humanities. In fact, 8 out of the bottom 10 fields among men and women were in arts or humanities. The lowest-paying field among male graduates was Drama/theatre arts and stagecraft (\$35,935), while for women, it was Bilingual, multilingual and multicultural education (\$19,892). Music graduates earned the third least for men (\$38,462) and second least for women (\$22,174). In the vast majority of cases, the median earnings of arts and humanities graduates were well below than the median earnings of all bachelor's degree graduates for both men and women.

Graduates from certain other disciplines outside of the arts and humanities also landed in the bottom 10. These included male and female graduates of Area studies programs, as well as male graduates of Anthropology, and female graduates of Research and experimental psychology.

Female and male graduates of female-dominated disciplines registered mixed results

Although several male-dominated disciplines ranked high in median earnings among male graduates (e.g. engineering, mathematics, or computer related fields), female-dominated disciplines (those with at least 75% of their graduates who are female) registered diverse outcomes.

In particular, nursing graduates ranked relatively high in terms of median earnings for both men and women. The median female graduate of Registered nursing, nursing administration, nursing research and clinical nursing earned \$73,169 (8th on the list). They were closely followed by Practical nursing, vocational nursing and nursing assistants in 13th place with median earnings of \$70,180. Although nursing is still a female-dominated area, men who chose to study Registered nursing, nursing administration, nursing research and clinical nursing also performed well in the labour market five years after graduation, with the median graduate earning \$82,079 (13th among male bachelor's degree graduates).

In general, nursing graduates earned considerably more than graduates of teacher education programs. Women who graduated from Teacher education and professional development, specific levels and methods (also female-dominated) registered \$48,330 in median earnings (slightly below the average for all female bachelor's degree graduates), while their male counterparts also landed below the average for all male bachelor's degree graduates with \$59,825 in median earnings.

Some graduates of female-dominated programs registered outcomes that were well-below average. For example, female graduates of Bilingual, multilingual and multicultural education registered \$19,892 in median earnings five years after graduation, which was last among the 123 fields that could be examined. Male graduates of Linguistic, comparative and related language studies and services also registered median earnings that were well-below the average for all male bachelor's degree graduates.

Graduates in male-dominated disciplines (those with at least 75% of their graduates who are male) generally outperformed their counterparts in female-dominated disciplines. In fact, both men and women in male-dominated disciplines registered median earnings that were above the average of all bachelor's degree graduates for their respective sexes. Male-dominated disciplines consisted primarily of engineering, computer- and business-related fields.

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Broad field of study classifications hide important differences in outcomes across specific disciplines

Many studies group disciplines in broad groups for ease of presentation. However, the results reported here suggest that this approach masks important differences within these broad groups.

For example, many health-related disciplines registered median earnings that were well-above the average among all bachelor's degree graduates. These included nursing and pharmacy programs (as noted above), and also Public health for both men and women. For women, it also included several other fields, such as Allied health diagnostic, intervention and treatment professions, Dental support services and allied professions, and Dietetics and clinical nutrition services. However, many health graduates registered below-average median earnings, such as Health services/allied health/health sciences (general) for both men and women, as well as several disciplines among women (e.g. Mental and social health services and allied professions; Rehabilitation and therapeutic professions).

Other broad program areas included disciplines that registered median earnings ranging from below-average to average, for the most part. Such was the case for science fields. Many biology-related disciplines registered below-average median earnings, while some programs were associated with slightly above-average median earnings (e.g. Physics and Physical sciences among men; Plant sciences and Geological and earth sciences/geosciences among women). In all cases, the median earnings registered by science graduates (including those in Physics and Chemistry) fell below those of engineering graduates. In most instances, the median earnings of biology-related disciplines were below those of health-related disciplines.

While some types of business graduates registered relatively high median earnings (e.g. Management sciences and quantitative methods—22nd among men and 9th among women), others registered relatively low median earnings (e.g. male Hospitality administration and Management graduates). In most cases, however, business graduates ranked above average in median earnings.

The median earnings of social science graduates generally ranged from average to well-below average for both sexes. For example, Social work graduates ranked slightly above average for women, and slightly below average for men. In contrast, Economics and Sociology graduates ranked well-below average for both sexes.¹³

Conclusion

This study reports on the median earnings of bachelor's degree graduates five years after graduation (prior to the COVID-19 pandemic), after adjusting for age, institution, and year of graduation. Results are shown for 118 fields for men and for 123 fields for women. This information is highly relevant to students, who must select specific disciplines and base their decisions in part on the earnings associated with disciplines.

The key findings are that graduates of various types of engineering programs generally rank at or near the top in terms of median earnings. Pharmacy graduates and graduates of other technical disciplines also predominantly performed well. In general, graduates near the top of the list earned multiple times more than those at the bottom (two to three times more for men, and two to five times more for women).

13. Frenette and Frank (2016) reported more favourable results for male and female bachelor's degree graduates of Economics programs, who earned more than the average bachelor's degree graduate. In contrast, male and female Social work graduates ranked near the bottom of all fields examined. Sociology graduates earned slightly less than the average bachelor's degree graduate. Since the authors had to include a wide range of graduates (those between the ages of 25 and 54 years-old), their results could be influenced by different long-term earnings trajectories experienced by graduates in various disciplines and/or by different outcomes experienced by individuals who graduated in different years.

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Female and male graduates of female-dominated disciplines registered a diverse range of median earnings, while those of male-dominated disciplines largely registered relatively high median earnings. The study also highlights the fact that reporting labour market outcomes by broad discipline classification (e.g. science) can be very misleading, as outcomes often vary considerably among more specific disciplines.

Given the divergent outcomes by detailed fields of study that are most often grouped together in related literature, future work in the area may benefit by reporting earnings for the most detailed fields of study possible in the available data. More generally, it will be important to continue tracking the earnings of graduates in specific disciplines as the results reported should be interpreted within the context of the prevailing economic conditions of the 2010s. Sectoral shifts in demand are common and may differentially impact graduates from various disciplines (e.g. oil and other natural resource extraction), while the COVID pandemic may have longer term implications for future graduates (e.g. telework, automation, health care needs, transition to clean energy, gig employment, etc.)

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