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Work-Ready Graduates: The Role of Co-op Programs in Labour Market Success

Participating in co-op programs is linked to higher incomes and a higher likelihood of success in the labour market after graduation, but some get more benefits than others.

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The Study In Brief

Adapting to the labour market after post-secondary education and finding a job that matches graduates' skills, while providing a good standard of living, can be a daunting challenge for new graduates. This *Commentary* investigates whether work-integrated learning (specifically co-op programs) results in higher incomes or other benefits after graduation. It provides an analysis of National Graduate Survey (2013) data to determine (i) the returns to participation in co-op for different fields of study at both the college and university levels, (ii) differential outcomes based on individual characteristics, and (iii) the effects associated with non-monetary success in the labor market. Estimates suggest that co-op programs have significant benefits for participants in the form of eased transition to the labor market and higher incomes after graduation and that they may play a role in overcoming wage gaps associated with bias toward individual characteristics (race, gender, immigration status).

Overall, participating in co-op generally appears to be beneficial for graduates' incomes – three years after graduation co-op participants have incomes about $2,000 to $4,000 higher than non-participants. At the college level, participating in co-op does not necessarily lead to higher incomes after graduation across all fields of study. There are, however, significant benefits to participating in co-op at the college level in science and engineering programs. Aggregate results, however, do not capture underlying and important differences in the effects associated with participating in co-op programs that depend on individuals' characteristics and chosen fields of study.

The estimated effect of participating in co-op programs differs for women, visible minorities and immigrants, relative to Canadian men. For visible minority and immigrant university graduates, participation in co-op programs is associated with similar incomes to white-male co-op participants. Female co-op program participants that graduated from university received wages similar to male peers that did not participate. Immigrants, women and visible minority individuals that participated in co-op were more likely to be employed full time than non-participants with similar characteristics. Women, unfortunately, tend to receive lower benefits than men from participating in co-op programs in terms of income, getting a first job related to their field of study, or securing a permanent position. Together, these results highlight that co-op programs and work-integrated learning more generally might have a role in reducing wage and employment gaps traditionally associated with bias toward individual characteristics.

Government policymakers and educational institutions should continue their support for expanding the programs so they are accessible to more students. At present, co-op programs in arts, education and social science do not appear to be as beneficial as the programs in STEM subjects. While co-ops are generally beneficial, the differences between fields of study suggests a need for caution in assuming that expanding co-op programs to more individuals or new areas would have the same benefits for new graduates as do current co-op programs. This highlights a need to carefully monitor the results of participating in co-op for students both during school and after graduation to continuously improve and adapt the programs to maximize benefits for individual fields of study.

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Successfully transitioning from education to the labour market is a significant challenge.

When students enrol in a post-secondary program, they are choosing to spend time and money on improving their skills and knowledge in the hope of earning higher wages after graduation. Finding a stable, well-paying job after they graduate can be a daunting and difficult transition, however, educational institutions provide myriad career services to assist them. Integrating work experience into educational programs is one approach to easing transition to the labour market.

Work-integrated learning (WIL) is meant to serve as a bridge from post-secondary education to the labour market by facilitating the chance to gain labour market experience during, or interspersed with, educational studies. Students gain the knowledge and skills they need in academic studies, and subsequently learn to apply those skills in a professional work environment. Similarly, following a work term, students can use their experience in the labour market to inform their course selections and apply their practical learning as they complete their education. These programs tend to take longer to complete, and may require higher investment in the form of tuition.

This *Commentary* investigates whether work-integrated learning – specifically, co-op programs – results in higher incomes or other benefits after graduation. Although there is ample evidence that WIL has positive outcomes for students, there is little concerning the differential effects by level of education and field of study. Put simply, most analysis has been performed on data for students at the university level, and predominantly in the science, technology, engineering and mathematics (STEM) fields. Despite relatively few Canadian research results, WIL has been increasing in popularity, and the growth of such learning and co-op programs has been boosted by federal and provincial government programs.[1] Results from analyzing data on graduates across the country show that:

- co-op programs have significant benefits associated with participation in the form of easing transition into the labour market and higher incomes after graduation; they also might play a role in overcoming wage gaps associated with bias toward individual characteristics;
- participation in co-op programs is also associated with a higher likelihood that a graduate's first job will be permanent and highly related to the graduate's field of study; three years after graduation, co-op participants are more likely to be employed full time and to have extended health benefits through work; and
- co-op programs in arts, education, and the social sciences do not appear to be as beneficial as those in STEM subjects;[2] although co-ops are generally beneficial, the difference between fields of study suggests a need for caution in assuming that expanding co-op programs to more individuals or new areas would have the same benefits for new graduates as current co-op programs.

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1 See Forum of Labour Market Ministers (2015); and Canada (2019a).

2 The reasons for this are beyond scope of what could be analyzed with the National Graduate Survey data, and would be a promising avenue for further research.

Government policymakers and educational institutions should continue their support for expanding co-op programs so they are accessible to more students, but they should also carefully monitor the results of participation by students both during school and after graduation to continuously improve and adapt the programs to maximize benefits for individual fields of study.

Work-Integrated Learning in Canada

Work-integrated learning is a catch-all term for programs of study that involve periods of professional experience in addition to academic course requirements. WIL is meant to serve as a bridge from post-secondary education to the labour market by facilitating the complementary development of academic and practical labour market skills. Students gain the knowledge and skills they need in academic studies, and subsequently learn to apply those skills in a professional work environment. Experience from work placements also might influence students' course selections and career expectations by providing them with relevant and timely information about the labour market.

The "work" part of WIL could be co-op positions, internships, field placements, supervised practicums, apprenticeships, or the engagement of students in applied research projects. These programs can be a formal requirement to reach certification (co-ops, apprenticeships, practicums and clinical placements) or in addition to formal academic education (applied projects, internships). Wages paid to students for these placements can also vary significantly, with some placements offering near-market wages and others being volunteer and unpaid. Students' rights to wages for these placements are governed by provincial employment standards legislation or, for students working in a federally regulated sector – such as for banks, mobile network operators, broadcasters or airlines – the Canada Labour Code. Most provincial legislation has some conditions under which students may not be entitled to the minimum wage or other labour protections governing hours of work, overtime and rest periods.[3] These standards vary province by province, but all have some form of exemption (either implicit or explicit) from certain employment standards when a person is receiving training for a trade, professional designated field or as part of an academic requirement.

The Costs and Benefits of WIL

WIL programs have many benefits for employers and students who participate. For students, benefits include learning discipline- or industry-specific skills, gaining information to form realistic career expectations and providing context to make academic work more meaningful (Grosjean 2000; Sattler 2011). Employers benefit from developing industry-specific workforce skills, streamlined recruitment and screening processes, and the ability to bring in specific talents and skills for short-term needs (Sattler and Peters 2012).

As a bridge to post-school employment, WIL also gives students relevant work experience that can be an advantage over other recent graduates in the labour market. Indeed, Lenarcic, Biss and Pichette (2018) show that post-secondary students perceive significant gaps between the skills they learn during studies and the professional skills

3 Prince Edward Island is the only province to include students and those training for a professional designation (apprenticeships, law, engineering, medicine and so on) under "employees," with all the associated rights and protections. For more information about exemptions by province, see Mandryk et al.; and Canadian Intern Association, "Employment Rights," available online at http://internassociation.ca/employment-rights/.

required on the job after graduation. Examples of such skills are: leadership, personal responsibility or work ethic, teamwork and business etiquette, among others. Integrating work experience with post-secondary studies might be an effective way to address these perceived gaps.

Studies examining co-op programs in US engineering programs show that 40 percent or more of co-op graduates accepted permanent employment offers from one of their co-op employers (Barry et al. 2016; Friel 1995; Wessels and Pumphrey 1995). A survey of employers in Ontario reveals that 52 percent of employers that hire post-secondary graduates offered employment to at least one graduate who had participated in WIL at the employer's firm, while another 9 percent hired at least one graduate who had completed WIL elsewhere (Sattler and Peters 2012). Co-op participation is associated with other benefits for students as well, including improved academic performance, confirmation of career choices and professional networking opportunities (Barry et al. 2016; Tran and Soejatminah 2016).

There are also costs associated with WIL. Post-secondary programs generally take longer to complete when they contain a WIL component.[4] They also might have higher tuition fees and additional course requirements. If WIL placements are not close to a student's home or educational institution, there are additional costs associated with moving and finding accommodation. For students, these costs represent a larger investment in their skills and knowledge at the beginning of their career, but, presumably, students who choose to enrol in post-secondary programs with WIL components see the potential future career benefits as worth the cost. Data from Statistics Canada's National Graduate Survey (2013) show that co-op participants are more likely to have debt when they graduate, and those that do have similar levels of debt as non-participants (Ferguson and Wang 2014). Co-op participants, however, have lower debt than non-participants three years after graduation (Table 1). This suggests that income from co-op work terms might be sufficient to offset higher tuition fees, and that co-op participants are paying off their debt faster than non-participants, on average.[5]

Employers might be able to attract technically skilled workers at a lower cost if they are willing to hire inexperienced students and undertake some professional development. Employers can treat WIL terms as extended job interviews, and offer full-time positions to the most successful students. The costs of WIL for employers are mostly associated with the time it takes to interview and hire students on an ongoing basis, the time it takes more senior employees to mentor the students and the uncertainty about the actual skill level of students being hired. In addition, depending on the type of WIL program, employers might be required to pay close-to-market wages to attract the most talented students, thus diminishing the benefit of hiring a student over a recent graduate.[6]

While actually taking part in WIL, furthermore, students might be overworked or underpaid relative to their abilities due to a lack of labour protection. In Ontario, less than two-thirds (58 percent) of employers offer compensation to WIL students

4 Co-op programs include work terms and academic terms. This does not necessarily mean that the programs take longer to complete.

5 This result refers to co-op programs specifically. They are a subset of the possible types of WIL where students spend at least 30 percent of their time in school on work terms and are paid for their labour.

6 For example, co-op students in an engineering program at the University of Waterloo earned $14–$38 per hour during their work terms in 2018 (University of Waterloo 2018). The average hourly wage for "natural and applied science" occupations – which includes engineers – was $36.62 per hour in 2018 (Statistics Canada 2018).

Table 1: Differences in Labour Market Outcomes between Students Graduating from Co-op and Non-co-op Programs

	Overall		College		Undergraduate	
	Co-op	Non-co-op	Co-op	Non-co-op	Co-op	Non-co-op
Regarding education						
Graduate would select same field of study (%)	77.1	75.4	75.26	73.6	78.7	74.6
Additional education since graduation (%)	34.6	42.7	30	36.9	41.7	50.1
First job after graduating						
Closely related to field of study (%)	56.2	40.8	56.4	46.9	56.7	33.4
First job is permanent (%)	63.6	52.6	67.7	58	59.4	50.9
Job, three years after graduation						
Number of employers since graduating	1.28	1.36	1.26	2.39	1.36	1.43
Income, job in survey week ($)*	47,900	45,000	41,700	40,900	55,200	49,300
Job has extended health benefits (%)*	75	70	81.5	70.5	69.4	69.4
Debt**						
At graduation ($)	13,400	13,000	11,700	10,800	14,800	14,000
In survey week, three years after graduation ($)	8,300	9,600	7,600	8,100	8,900	10,700

Note: Results that are statistically significant at the 95 percent level are shown in black, non-statistically significant results are shown in grey.
*Sample restricted to respondents with employment three years after graduation. The survey data for income are censored above $100,000.
** The survey data for student debt are censored for values above $25,000.

(Sattler and Peters 2012). In addition, not all types of WIL are comparable in terms of the experiences students gain. The employer could choose not to mentor students during the WIL term, but simply treat them as typical short-term contract employees, increasing the employer's benefit through lower costs at the expense of the students' benefit. Due to uncertainty on the part of both the employer and the students, and the possibility that WIL can improve job matching and ease the transition from school to the labour market, there might be a continuing need for government subsidization of WIL salaries to encourage businesses to take part.

To ensure that both employers and students receive the largest possible benefit from participating in WIL programs, there is a need for clear and transparent information about work placements. Post-secondary institutions have a role to play in clarifying the expectations of both participating students and employers, and in communicating with both to ensure that the skills and knowledge students are taught are actually

integrated into the work students do in these placements.[7]

Government and Institutional Policy on Work Integrated Learning

As discussed, the "work" part of WIL could be a co-op position, internship, field placement, supervised practicum or apprenticeship, or applied research project. These programs can be a formal requirement to reach certification or in addition to formal academic education. The differences between the two types vary by province and educational institution. WIL that is required as part of certification generally involves longer, better-paid work terms, and is accredited by some external body.

Accreditation of a WIL program by an external licensing body is a signal of the value of the credential to both students choosing a program of study and employers choosing institutions from which to select students. WIL that is part of the licensing requirement for a professional occupation such as law, medicine or accounting takes different forms. Accreditation for these professions is not specific to educational institutions, but is generally overseen by a professional licensing body or by government regulations that require practical experience before a person can be licensed to practice in that profession. For example, doctors must be licensed by the Provincial Medical Regulatory Authority in the province in which they practice. Lawyers similarly must be licensed by one of the 14 members of the Federation of Law Societies of Canada and hold accreditation from a qualifying law school. Apprenticeships have specific requirements for each regulated trade, and the requirements may vary by province. "Red Seal Trades" – a sub-group of trades governed by regulations under provincial and territorial apprenticeship acts – allow a tradesperson to work in other provinces and territories without needing to be recertified.

Cooperative education programs are more general, and are accredited by Co-operative Education and Work-Integrated Learning Canada. In order to qualify, programs must ensure that: (i) students are engaged in productive work that complements their education and for which they receive remuneration, (ii) the students' performance is monitored by both the co-op program and employers, (iii) co-op work experience is at least 30 percent of time spent in academic study and (iv) the program begins and ends with an academic term (see CEWIL 2017). Not all WIL programs are accredited, and the accreditation of co-operative education programs does not necessarily guarantee that the work experience will be relevant to the field of study or that remuneration will be comparable to market wages for employees in the same occupation.

Unpaid internships can be legal in some provinces, but are generally tightly controlled as to the types of work that can be done. There are also some "volunteer" placements that suspiciously resemble employment. This opens the door to exploitative employment practices by unscrupulous employers interested in free labour. An employer might imply the prospect of a paid job in the future, and require the intern for long and underpaid hours in the meantime. Most unpaid internships are unlawful, but few victims complain for fear of personal reputational damage at the start of their career (Whitten 2013). Additionally, survey results indicate that, even though interns received little in

7 An analysis of work-integrated learning in Australian universities found that the aspects of WIL that students feel are most important to their learning broadly align with best practice principles identified in research and institutional guidelines. Further, many of the problems and difficulties students experienced in performing certain skills during placement could be attributed largely to poor program design (Jackson 2015).

the way of tangible job-marketing or networking benefits from their position, they believed that such benefits would materialize in the future (Attfield and Couture 2014). For interns, the perceived benefits of internships are closely related to future employability. Internships are more common in highly competitive fields where job openings are few, and salaries are below the median. When faced with below-median wage prospects and a highly competitive labour market, economic theory suggests that these interns would be better served by transitioning to a field with better wage prospects; however, internships are "rationalized on the basis of significant time and money that interns invest into their particular career path through school and previous unpaid work experience. In the eyes of the interns, moving into a different field would mean that this investment was wasted" (Attfield and Couture 2014, 29). This is a classic example of the sunk cost fallacy.

There are also numerous government policies to facilitate WIL programs. Across Canada, employers can claim up to $2,000 per year for each qualifying apprentice under the Apprenticeship Job Creation Tax Credit. In Ontario, employers can claim the Co-operative Education Tax Credit, which covers 25 to 30 percent of eligible expenditures up to $3,000 for each work placement. In 2016, the federal budget designated $73 million over four years for the Post-Secondary Industry Partnership and Co-operative Placement Initiative. The initiative is directed to support partnerships between employers and willing post-secondary education institutions, and to increase WIL opportunities in STEM and business fields. In addition, the 2016 federal budget allocated $14 million over two years to the Mitacs Globalink program to fund 825 internships and fellowships annually. The 2019 federal budget rebranded the program as the Student Work Placement Program and expanded it by an additional $631.2 million over five years, with the goal of creating up to 20,000 new work placements across all disciplines.[8] With potential benefits to both students and employers, significant regulatory involvement and the subsidization of WIL through tax credits, the actual effects of WIL on the employment prospects of graduates need to be investigated and weighed against the potential downsides.

Work-Integrated Learning: Stylized Facts

To investigate the effects of work-integrated learning on the employment outcomes of students after graduation, I used data from the 2013 National Graduate Survey. The NGS surveys graduates about their labour market status, and contains demographic and educational information. It also contains qualitative information about graduates' satisfaction with their program of study and whether their labour market outcome corresponds to their expectations. From these responses, it is clear that co-op programs are associated with numerous positive labour market characteristics, but that these benefits vary by type and field of study. Graduates from co-op programs have higher incomes, are more likely to get a permanent position following school and are less likely to have taken further schooling since graduating (Table 1).

8 The 2019 federal budget also allocated an additional $150 million over four years to Employment and Social Development Canada "to create partnerships with innovative businesses to create up to a further 20,000 work-integrated learning opportunities per year" (Canada 2019b, 54). It also allocated $17 million over three years to Innovation Science and Economic Development Canada to support the Business/Higher Education Roundtable to engage industry in creating 44,000 additional WIL opportunities for students (see Business/Higher Education Roundtable 2016).

Comparing the average outcomes of graduates, co-op programs show significant benefits over non–co-op programs. Students graduating from co-op programs at both university and college are more likely than their non–co-op peers to have their first job be permanent and closely related to their field of study (Table 1). Similarly, graduates of co-op programs who are employed three years after graduation have significantly higher incomes than non-participating peers. Regardless of employment status, graduates who participated in co-op programs have lower debt than their peers three years after graduation, despite having similar levels of debt at graduation.

This is, however, likely an overgeneralization of the benefits of co-op programs. Investigating outcomes by field of study shows that the benefits of such programs vary with the field of study and type of educational institution attended (university or college) (Table 2). Graduates of co-op programs at universities are more likely to get a first job closely related to their field of study across all fields. College co-op graduates, on the other hand, are significantly more likely to have a first job related to their field of study only if their program is in engineering or social science. Three years after graduation, the advantage of co-op graduates almost entirely disappears outside university math, computer science, engineering and health programs.

Graduates of post-secondary co-op programs enjoy many benefits compared to non–co-op graduates, but across fields of study and institution type, the benefits are less clear. In addition, many factors beyond one's program of study determine employment status after graduation. In the next section, I investigate the effect of co-op programs on employment outcomes while controlling for various sociodemographic characteristics.

Participation in Co-op Programs: Associated Effects on Employment and Income

Students choose their post-secondary fields and institutions of study based on their personal preferences, the advice of their peers, parents and teachers, their perceived future earning potential and many other factors. This makes evaluating the returns to education and the effect of co-op programs difficult. It might be the case that the most high achieving or ablest students are the ones who choose to enrol in co-op programs, and that doing so gives them a slightly larger advantage than they would have had otherwise.[9] It might also be the case that students who enrol in such programs are relatively disadvantaged, and co-op programs therefore furnish them with relevant work experience and level their odds in the labour market.

To evaluate the effect of co-op programs on labour market outcomes, I used various regression techniques to control for differences between students that affect their enrolment choices and post-graduation labour market outcomes.[10]

Income Outcomes

To estimate the effect of co-op participation on the incomes of graduates, I used ordinary least squares linear regressions and controlled for relevant sociodemographic variables and the students' field

9 Co-op graduates typically have higher grade point averages than non-co-op graduates (Blair and Millea 2004; Finnie and Miyairi 2017).

10 All regressions control for students' observed characteristics and field of study, and use linear or logistic models to estimate the returns to co-op participation. For details on methodology, see the Appendix.

Table 2: Average Difference Between Co-op Program Outcomes, Universities vs. Colleges, Percent

	Additional Education since Graduation		First Job				Job Three Years after Graduation			
			Closely Related to Field of Study		First Job is Permanent		Closely Related to Field of Study		Job Has Extended Health Benefits	
	University	College	University	College	University	College	University	College	University	College
Education	9	-7	20	3	6	20	-10	11	-6	-13
Arts	-19	-19	22	11	12	17	0	3	5	10
Humanities	-33	-45	32	14	-5	27	10	12	27	13
Social science	-12	-6	9	18	-7	17	-3	3	-1	-9
Business	9	2	18	0	8	7	7	8	6	2
Science	2	-26	23	10	18	-10	6	-11	6	14
Math & computer science	-14	-5	31	-1	2	5	21	-8	14	14
Engineering	-7	-1	13	21	14	-1	14	3	5	0
Health	-9	-16	25	-3	-14	14	10	-4	-1	-16

Note: Results that are statistically significant at the 95 percent level are shown in black, non-statistically significant results are shown in grey.

of study.[11] Results indicate that participating in a co-op program is associated with about $4,300 higher income three years after graduation at the university level (Table 3). At the college level, however, participating in a co-op program does not appear to lead to significantly higher incomes three years after graduation.

One factor that is not controlled for in the above method is the possibility that sociodemographic characteristics and field of study affect both the likelihood of participating in a co-op program and labour market outcomes after graduation. To extend the analysis to control for this possibility, I estimated the likelihood of participating in a co-op program, and used both this "propensity" to participate and individual characteristics to match similar individuals in the data.[12] This method mimics an experiment by choosing a comparison group from all non–co-op participants that is most similar to co-op participants. Under this matching assumption, all outcome-relevant differences between any two individuals are captured in their observable attributes, and the only remaining difference between the two groups

11 Sociodemographic control variables include: age, gender, immigration/citizenship status, number of dependent children, marital status and whether the individual identifies as a visible minority.

12 For details on estimating propensity to participate in a co-op program and the implementation of the matching method, see the Appendix.

is co-op participation.[13] I then estimated the linear regressions with the relevant controls using this restricted matched sample of the data. The results show that the effect of participating in a co-op program is likely slightly underestimated when using unmatched data, although results are quite similar (Table 3).[14] Co-op participation is linked to about a $4,130 increase in annual income for university graduates and weak evidence of a slight increase in the income of college graduates, although the result is not statistically significant.

Table 3: Estimated Effect of Participating in Co-op on Incomes Three Years After Graduation

	Unmatched Data	Matched Data
All	$2040 (***)	$3110 (***)
University	$4,280 (***)	$4,130 (***)
College	$60	$2,160

Notes: Statistical significance is coded: (***) > 99.9% confidence, (**) > 99% confidence, (*) > 95% confidence, and (.) > 90% confidence. Sample restricted to employed graduates. Sample sizes: all = 7508, university = 4606, college = 2902.

Source: National Graduate Survey 2013 – Public Use Microdata, author's calculations.

Gender, Race and Immigration Status: Co-op Programs and Earnings Gaps

Next, I investigated whether wage premiums associated with co-op participation are affected by individual characteristics – in particular, whether a person's gender, ethnicity or immigration status affected their wages three years after graduation and whether participation in a co-op program is an important factor. The results show, first, that women and immigrants have lower incomes than others three years after graduation, but there are some interesting differences by level of education (Figure 1). Visible minority individuals do not appear to be at a significant disadvantage in terms of wages compared to their peers. Immigrant graduates receive wages that are, on average, $2,400 lower than those of non-immigrants. Women are at the largest disadvantage, receiving incomes about $6,000 lower than their male peers three years after graduation.

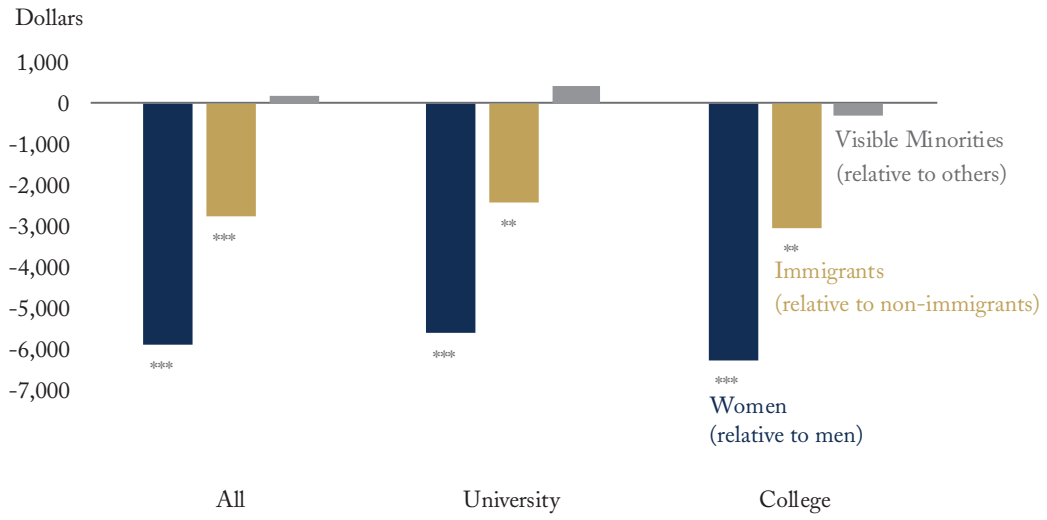
To investigate whether co-op participation affects graduates' wages differently based on individual characteristics, I added interaction terms for each characteristic to the wage estimation model.[15] Results show that participation in a co-op program affects after-graduation income differently for immigrant, visible minority and female university students, but few of the estimated coefficient results for the interaction terms are statistically significant (Figure 2). Compared to their non–co-op white male peers, the effect of participating in a co-op program differs

13 For more on methods of statistical analysis for non-experimental data and recovering returns to education using individual data, see Blundell Dearden and Sianesi (2001).

14 One of the underlying reasons for differences between the two results is that the likelihood of participating in a co-op program is affected by field of study and level of education, with students in maths, computer science and engineering much more likely to participate. Similarly, co-op participation is more likely for college students than for university students. In the matched sample, there are remaining significant differences between co-op participants and non-participants in engineering and social sciences. Although interpretation of the results suggests that there is a wage premium associated with co-op participation, it might not be purely causal due to underlying differences that cannot be controlled for with the available data. Including field of study as a control variable in the regressions using matched data should be sufficient to control for differences in income by field of study, but cannot separate the effect of co-op participation and field of study.

15 Estimations use the matched data set; coefficients for interactions terms and their significance can be found in Appendix Table A3.

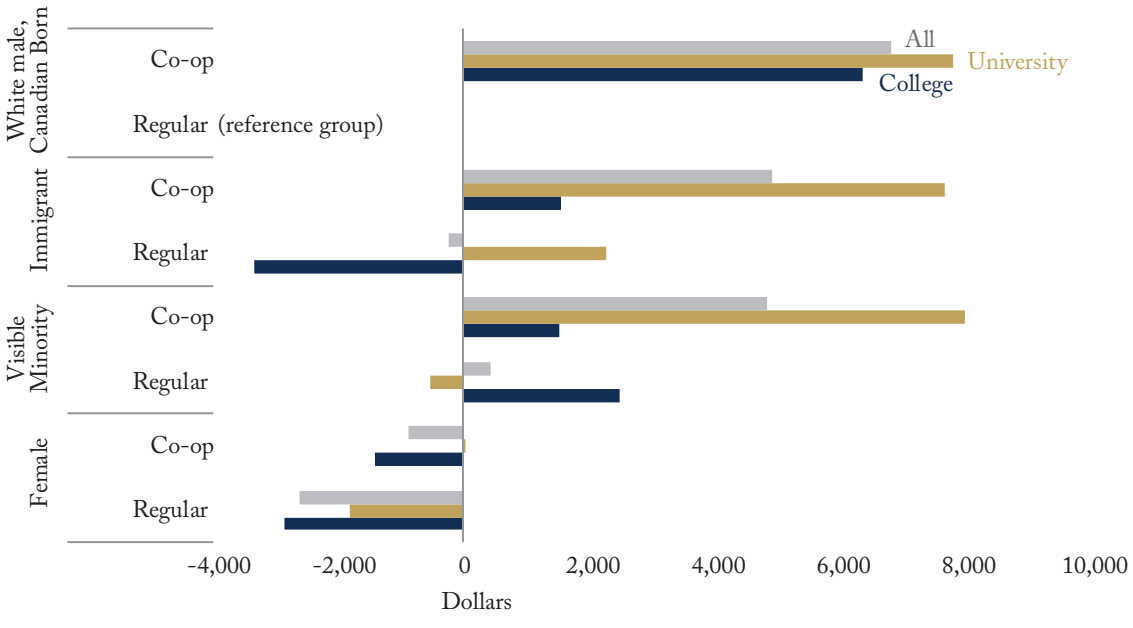
Figure 1: Individual Characteristics and Wages, All Graduates, Three Years after Graduation



Notes: *** = >99.9% confidence. ** = >99% confidence. The reference population for each group is corresponding counterparts (e.g. the earnings of immigrants relative to non-immigrants and that of women compared to men). Sample sizes: all = 2316, university = 1153, college = 1161.

Sources: National Graduate Survey 2013, Public Use Microdata, author's calculations.

Figure 2: Wage Gaps and Co-op Participation, Three Years after Graduation



Notes: Results include graduates with employment three years after graduation. The reference population for all groups is white male Canadian-born non-co-op graduates.

Sources: National Graduate Survey 2013, Public Use Microdata, author's calculations.

significantly for women at both the university and college levels and for visible minorities at the college level, but not for immigrants.

Visible minorities appear to receive income benefits from participating in a co-op program at the university level that are similar to those of their white peers. At the college level, however, visible minority co-op participants have lower incomes than visible minority graduates who did not participate. Women, already at a disadvantage in terms of income after graduation, receive wages that are about $4,500 to $6,500 lower than those of their male peers. Participating in a co-op program reduces the disadvantage, but does not overcome it: female co-op participants receive incomes about $3,000 lower than male peers who did not participate, all other things equal.

Differing returns to participating in a co-op program for different population groups suggest that these programs might play a role in eliminating or reducing wage gaps in the labour market. In particular, visible minority individuals who participate in a co-op program at the university level receive larger returns than those of their white male peers. Moreover, these returns are, on average, sufficient to offset the wage penalty associated with race. Unfortunately, the opposite appears to be true for women, who receive lower returns to co-op participation than their male peers. Women who participate in a co-op program at the university level, however, receive wages closer to the average of all graduates than do non-participating female peers. Further, visible minorities and immigrants are more likely, and women less likely, to participate in a co-op program. Although the estimation method used for this part of the analysis was not sufficient to link individual characteristics causally to different returns to co-op participation, these results suggest that co-op programs could have a moderating effect on wage gaps.[16]

Income and Field of Study

The income graduates earn is linked to their chosen field of study while in school. Students choose their field of study for various reasons including personal interest, individual abilities and potential career paths (with varying levels of income) that could follow education. In the previous section, I investigated links between individual characteristics, co-op participation and income after graduation; here, I determine whether returns associated with participating in a co-op program vary with graduates' field of study.

To investigate differences in income and co-op participation by field of study, I calculated weighted average participation rates and incomes for each field and level of education (Table 4). The results show, rather unsurprisingly, that graduates who studied business, mathematics, computer science or engineering earn more, on average, than arts and education graduates. Across all fields of study, only university graduates earn significantly higher incomes after graduation. Increased incomes associated with co-op participation across all fields, however, might be disproportionately driven by particular fields of study. At the college level, students in business and health programs who participated in a co-op program earn less than their non-participating peers.

Science, engineering, math and computer science students receive significantly higher incomes three years after graduation. At the university

16 Differences in wages and co-op participation might be linked to the choice of field of study. Co-op programs are overrepresented in STEM subjects, with relatively few for humanities and arts. The underrepresentation of women in co-op programs might be an artifact of their underrepresentation in some STEM fields. Further, differences in wages after graduation might relate to individual choices regarding career path or specialty/sub-domain within fields of study.

Table 4: Co-op Participation and Income by Field of Study

	All			University			College		
	Co-op Participation	Income ($)		Co-op Participation	Income ($)		Co-op Participation	Income ($)	
	(%)	Regular	Co-op	(%)	Regular	Co-op	(%)	Regular	Co-op
All Fields	16	51,500	52,600	13	**54,400**	**60,100**	25	46,000	46,100
Education	9	51,700	48,500	8	52,500	50,300	19	45,000	43,000
Arts	11	40,200	37,800	14	41,900	40,500	12	37,800	33,300
Ssocial Sciences	12	**49,500**	**44,600**	6	52,400	51,700	29	37,600	39,800
Humanities	3	48,100	53,900	3	49,200	58,300	7	37,800	36,700
Business	21	51,400	48,800	17	**55,100**	**59,300**	30	**44,200**	**39,300**
Science	11	48,000	53,000	9	48,200	53,100	36	41,400	52,700
Math and Computer Science	25	**52,000**	**61,900**	32	**56,000**	**66,500**	19	47,300	51,200
Engineering	32	**57,800**	**63,100**	35	**62,900**	**68,100**	30	**54,600**	**59,300**
Health	14	**57,100**	**52,900**	13	64,100	65,000	18	49,100	43,600

Notes: Results that are statistically significant at the 95 percent level are shown in bold, results that are significant at a 90 percent confidence are shown in black, non-statistically significant results are shown in grey. Includes survey respondents with fulltime employment three years after graduation, sample sizes: all = 6,483, university = 4,011, college = 2,472.

Source: National Graduate Survey 2013, Public Use Microdata, author's calculations.

level, graduates of business and humanities[17] programs also receive higher incomes on average. At both colleges and universities, graduates of arts, education and social science[18] programs receive similar wages, whether or not they participated in a co-op program. At the university level, math and computer science participants in a co-op program receive about $10,500 more than non-participants – the largest statistically significant premium of all fields of study. Science, business and engineering university graduates make about $4,000 to $5,000 more three years after graduation if they participated in a co-op program. At the college level, science students participating in a co-op program receive the most benefit, with incomes about $11,300 more than non-participants,

17 Results are statistically significant, but very few humanities graduates participated in co-op programs (3 percent); accordingly, this result might not be generalizable.

18 At the aggregate level, social science graduates who participated in a co-op program earn significantly lower wages than non-participating peers. At the college level, co-op participants make slightly higher wages, but the result is not statistically significant (p-val = 0.22). At the university level, co-op participants make lower wages on average, but this result is also not statistically significant (p-val = 0.82).

though the difference is not statistically significant. One interesting observation from the results in Table 4 is that fields of study associated with larger benefits from participating in a co-op program also generally have higher levels of participation.

These findings are generally consistent with similar research using different data sources. Finnie and Miyairi (2017) analyze income tax–linked data from 14 Canadian post-secondary institutions, and find that degree and diploma graduates who participated in a co-op program earn about $15,000 and $8,000 more, respectively, than their non-participating peers after graduation. The authors also find that the wage differential between co-op participants and non-participants was largest in business, engineering, math and computer science at the degree level, that the co-op wage gap for diploma graduates is highest for math and engineering graduates and that business co-op graduates do not receive higher wages than their non-participating peers. After accounting for graduates' grades, the authors find that earnings premiums associated with co-op were smaller than initial estimates,[19] but that the earnings of co-op participants were greater than those of non-participants even after accounting for grades.

Students' decisions to participate in a co-op program might be related to the expected increase in income after graduation. It might also be the case that universities and colleges offer more co-op programs in fields of study where such programs are more beneficial for students. About a third of engineering graduates and a quarter of math and computer science graduates participated in a co-op program at the university level, compared with 16 percent across all fields. Similarly, about 30 percent of science and engineering students at the college level participated in a co-op program. The link between higher income and co-op participation levels is relatively strong at both the university and college levels.[20] Interestingly, 30 percent of business and social science college graduates participated in a co-op program, but they did not receive significantly higher average incomes than non-participating peers. Although there are many reasons to participate in a co-op program beyond the expectation of higher income after graduation, these programs tend to take longer to complete and have higher tuition fees.

The Income Effect of Co-op Participation: Summary

Overall, participating in co-op is generally associated with higher incomes following graduation at the university level – three years after graduation co-op participants have incomes about $4,000 higher than non-participants (Table 3). At the college level, participating in co-op does not necessarily lead to higher incomes after graduation across all fields of study. There are, however, benefits to participating in co-op at the college level in science and engineering programs.

Aggregate results, however, do not capture underlying and important differences in the benefits of co-op participation that depend on individuals' characteristics. In particular, visible minority individuals who participate in university co-op programs receive larger returns than their peers, and these larger returns are generally sufficient to offset the wage penalty associated with race. Similarly, immigrant university graduates who participated in a co-op program have incomes equivalent

19 Students' grades and institution of study are two factors that could not be included in the analysis, as this information is not available in the NGS public-use microdata.

20 The correlation between the co-op participation rate and the difference in income associated with participation is 0.41 at the university level and 0.59 at the college level. If graduates of humanities programs are removed, the correlation increases to 0.60 across both levels of study (0.74 at the university level and 0.66 at the college level).

to Canadian-born, white male peers who also graduated from a co-op program. Unfortunately, the opposite appears to be true for women, who receive lower returns to co-op participation than their male peers. Women that participate in co-op, however, receive wages closer to Canadian-born, white male peers than non-participating female graduates. Such differing returns to co-op programs for different population groups suggest that these programs might play a role in reducing or eliminating wage gaps in the labour market.

Income returns to participating in a co-op program also differ by the chosen field of study. Programs in science, engineering, maths and computer science are associated with larger increases in income three years after graduation, while social science, arts, health and education co-op programs are not generally associated with higher incomes after graduation.

Differences that depend on individual characteristics and field of study suggest that expanding co-op programs to more students or into new domains of expertise would not necessarily result in similar benefits, especially since not all fields of study appear to receive a wage premium after participating in co-op and a minority of students participate. University graduates of co-op programs receive higher wages than their non-participating peers, but only 13 percent of graduates participate. College graduates make similar average incomes, whether or not they graduated from a co-op program, and 25 percent of students participate. The observation that the income benefits of participating in a co-op program might be driven predominantly by graduates of STEM programs – who also receive higher wages on average – also highlights that we cannot assume that new co-op programs would result in the same benefit for graduates as do current programs.

Success in the labour market, however, is not entirely based on wages. Co-op programs could have the additional benefits of learning professional communication skills, gaining information about the labour market and improving personal career prospects. For international students, attending a Canadian post-secondary institution can be an avenue to permanent residency, and co-op programs can help newcomers become familiar with hiring and cultural business practices. Australian research shows that international students perceive work-integrated learning opportunities as enhancing not only their employability and competitive advantage in the labour market, but also their social connectedness with people outside their academic studies (Tran and Soejatminah 2016).

Co-op Participation and Non-wage Labour Market Outcomes

Successful transition to the labour market after school is about more than what graduates earn. In this section, I analyze whether co-op participation is associated with easier entry into the labour market and whether there are perceptible differences for employment three years after graduation. The National Graduate Survey asks respondents for information about their first job after school and their employment during the survey week (three years after graduation). These questions yield information about security of employment, whether respondents' first job was related to their field of study and whether or not their job provided extended health benefits, among other things.

To determine whether participating in a co-op program is associated with a higher likelihood of success in the labour market after graduation, I used logistic regressions to control for respondents' observable sociodemographic attributes and field

Table 5: Estimated Effect of Co-op Participation on Labour Market Outcomes, Percent

		All	University	College
First Job	Job is permanent	20.3 (***)	-2	40.5 (***)
	Job highly related to field of study	55.8 (***)	83.4 (***)	27.9 (***)
Three years after Graduation	Employed fulltime	42.2 (***)	34.2 (***)	51.2 (***)
	Job provides extended health benefits*	13.4 (***)	48.5 (***)	-6.1 (***)

Notes: Statistical significance is coded: (***) > 99.9% confidence, (**) > 99% confidence, (*) > 95% confidence, and (.) > 90% confidence. Sample restricted to graduates in the labour force.

*Sample restricted to survey respondents with employment three years after graduation.

Sources: National Graduate Survey 2013 – Public Use Microdata, author's calculations.

of study.[21] The results show that, across levels of education, co-op participants were 56 percent more likely than non-participants to have had their first job be related to their field of study (Table 5). College graduates who participated in a co-op program were 40.5 percent more likely to have had their first job be permanent, but there was no statistically significant difference between participants and non-participants at the university level. Moreover, the benefits of participating in a co-op program do not appear to diminish quickly: three years after graduation, co-op participants were 42.2 percent more likely to be employed full time, and 13.4 percent more likely to have extended health benefits through work, than non-participants.

Estimates suggest that women and immigrants are less likely than their peers to have success in the labour market, whether they participated in co-op or not. They are less likely to have their first job after school be a permanent position and to have extended health benefits three years after graduation. Visible minorities are also generally less likely than their peers to have their first job be related to their field of study. Women and visible minorities are less likely to be employed full time three years after graduation.

To investigate the effect of co-op participation on labour market outcomes for these population groups, I added interaction terms to the regressions for each characteristic. The results show that, for all groups, participating in a co-op program improved the odds of a graduate's first job being related to their field of study and of being employed full time three years after graduation. As well, immigrant and male co-op participants were more likely to have had their first job be permanent, but participation did not substantially improve such odds for women and visible minorities.

21 The regressions used an unmatched dataset (n = 8013), 4,904 responses from university graduates and 3,109 from college graduates. For the regression estimating the effect of co-op participation on the likelihood of having extended health benefits provided by an employer, the sample includes graduates with employment three years after graduation (n = 7,508).

Of particular interest is that participation in a co-op program was associated with the increased likelihood of being employed full time, and that the increase was greater for women, minorities and immigrants than for men (Figure 3). This result suggests that participating in a co-op program might lead to higher labour market attachment and success for these marginalized groups. It could also be the case that those who choose to participate in a co-op program are more career focused and, therefore, more likely to be employed full time three years after graduation, but that does not explain the differing results depending on individual characteristics. The methodology I used cannot determine with certainty that co-op participation is the cause of higher success in the labour market, only that it is associated with improved outcomes. Still, the results suggest that participating in a co-op program is more likely to lead to successful transition to the labour market and might have additional benefits for marginalized groups.

Discussion and Policy Implications

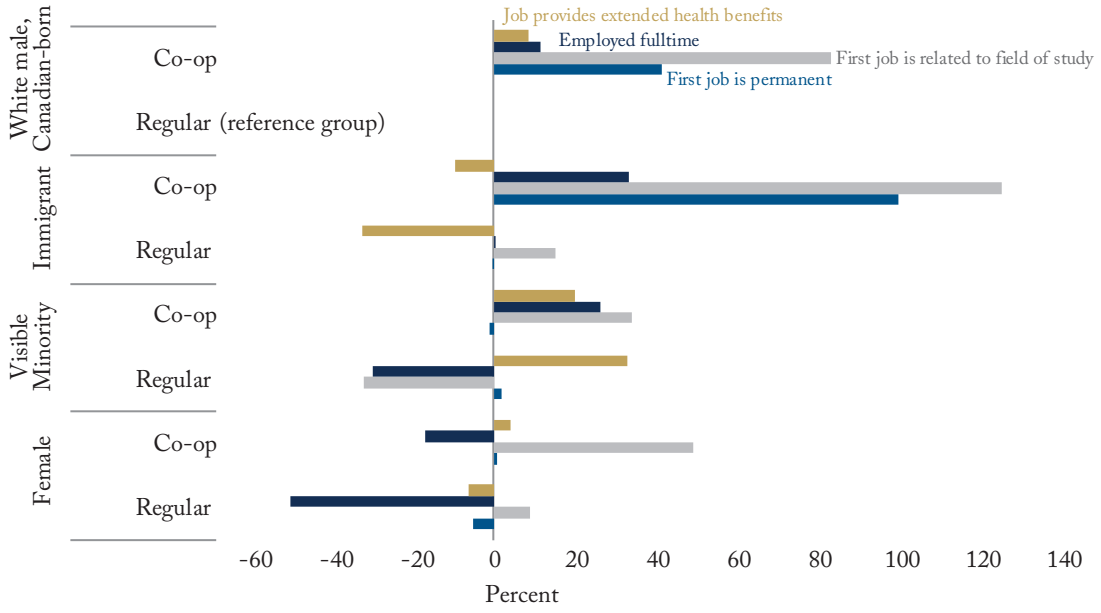
Analysis shows that participation in a co-op program is beneficial for successful transition to the labour market for new graduates in terms of income, full-time employment, and occupational relevance to their field of study. Further, co-op participants maintain an advantage in the labour market three years after graduation. There are significant differences in benefits, however, depending on individual characteristics and areas of study, with important implications for government policies supporting work-integrated learning programs and the potential effects of expanding them into new domains.

Across fields and levels of study, co-op graduates make about $3,100 more than their non-participating peers.[22] These positive results, however, hide important underlying differences in returns associated with co-op participation that depend on field of study. For both university and college graduates, participating in a co-op program is associated with higher incomes three years after graduation if they studied science, engineering, maths or computer science. Graduates of business programs at the university level have higher incomes if they participated in co-op, but not at the college level. There are no income premiums associated with co-op participation for graduates of education, arts or social science programs, for reasons beyond the scope of what one can analyze with the NGS data. It is possible that lower availability of, or participation in, co-op programs in these fields results in small sample bias. It could also be the case that practicums, field work or other WIL components are more widely used in these fields, and that co-op programs are not statistically or practically different than these other WIL options in determining labour market outcomes after graduation. At present, co-op programs in arts or education do not appear to be associated with an advantage in the labour market in terms of income, but university graduates in these fields who participated in a co-op program are more likely to have their first job related to their field of study (Table 2, Table 4).

These results highlight the need for caution in expanding co-op programs to new domains or fields of study. Institutions should not assume that a co-op program that is valuable to students in engineering would be as beneficial to students in other disciplines if it were simply expanded under the same format. Co-op programs nevertheless

22 After controlling for individual differences and analyzing a quasi-experimental dataset. The amounts are $4,130 for university graduates and $2,160 for college graduates, although the result for the latter is not statistically significant.

Figure 3: Co-op Participation and Labour Market Outcome Gaps



Notes: Sample restricted to graduates in the labour force for all results except "job provides extended health benefits" which uses the sample restricted to survey respondents with employment three years after graduation. The reference population for all groups is white male Canadian-born non-co-op graduates.

Sources: National Graduate Survey 2013 – Public Use Microdata, author's calculations.

might ease the transition to the labour market for graduates in these fields, as participants are more likely than their peers to have their first job be permanent and related to their field of study. In addition, co-op participants are less likely to have gone back to school for additional formal education three years after graduating from an arts or humanities program.

The estimated effect of participating in a co-op program differs for women, visible minorities and immigrants relative to Canadian-born, white men. For visible minority and immigrant university graduates, participating in a co-op program is associated with similar incomes to white male participants. At the college level, immigrant graduates who participated in a co-op program receive higher wages than non-immigrant peers who did not participate. Immigrants, women and visible minority co-op participants are more likely to be employed full time than non-participants with similar characteristics. Women, unfortunately, tend to receive lower benefits than men from participating in a co-op program in terms of income and having their first job be related to their field of study or be a permanent position.

Together, these results suggest that co-op programs, and work-integrated learning more generally, might have a role to play in reducing wage and employment gaps traditionally associated with bias toward individual characteristics. Women who participate in a co-op program receive wages closer to those of non-participating male peers than women who do not participate. For immigrant and visible minority university graduates, the returns to co-op participation are sufficient on average to overcome the wage gap. All other things being equal, visible minority university graduates receive wages about $500 lower than their peers; wages of minority co-op participants, however, are $8,000 above average and equivalent to the wages of

white, Canadian-born male university graduates who participated in a co-op program. Women and immigrants are more likely to participate in a co-op program than are Canadian-born males; there is no significant difference in participation rates between visible minorities and whites.

In conclusion, co-op programs have significant benefits for participants in the form of easing transition to the labour market and higher incomes after graduation. They also might play a role in overcoming wage gaps associated with bias toward individual characteristics. Policymakers and educational institutions should continue their support for making co-op programs accessible to more students. At present, co-op programs in arts, education and social science do not appear to be as beneficial as programs in STEM subjects.[23] Further, differences in labour market outcomes among fields of study suggest a need for caution in assuming that expanding co-op programs to more individuals or new areas would have the same benefits for new graduates as current co-op programs. What is needed is careful monitoring of the results of participating in co-op programs for students both during school and after graduation to continuously improve and adapt these programs to maximize benefit for individual fields of study.

23 The reasons for this are beyond scope of what can be analyzed with the NGS data, and would be a promising avenue for further research.

Appendix: Regression Methods and Extended Results

Estimating the Income Returns to Participation in Co-op Programs

To estimate the effect of participation in a co-op program on graduates' incomes three years after graduation, I employed two regression methods. First, I used an ordinary least squares regression, with income as the dependent variable to estimate the coefficient of interest (binary co-op participation variable) while controlling for sociodemographic characteristics and field of study. Sociodemographic control variables include: gender, age, marital status, number of dependent children, immigration status and race. In addition, dummy variables that indicate graduates' fields of study while in post-secondary education and whether they are employed part or full time are included as additional controls. For detailed results for these regressions, see Table A1. To determine differential effects by type of postsecondary institution, the model was run with the full sample of employed graduates and with the subsets of university and college graduates individually.

To investigate whether co-op participation affects graduates' wages differently based on individual characteristics, I added interaction terms for each characteristic to the simple linear wage estimation model. In particular, I examined if gender, ethnicity or immigration status affects graduates' wages three years after graduation and if co-op participation is an important factor. The results show that participation in a co-op program affects wages after graduation differently for immigrant, visible minority and female university students (Table A1).

One factor not controlled for in the above method is the possibility that sociodemographic characteristics and field of study affect both the likelihood of participating in a co-op program and labour market outcomes after graduation – a potential selection bias problem. To extend the analysis to control for this possibility, I estimated the likelihood of participating in a co-op program, and used both this "propensity" to participate and individual characteristics to match similar individuals in the data. To estimate the likelihood of an individual's participating in a co-op program, I used a logistic regression where the outcome is a binary co-op participation variable. Dependent variables are covariates that relate to both co-op participation and income after graduation – namely, chosen field of study, type of institution, parents' level of education and other sociodemographic characteristics. All covariates are significantly related to participation in a co-op program with the exception of being a visible minority, which is significant at a 10 percent confidence level (Table A2).

To select a subset of the sample data that mimicked experimental conditions, I executed a matching algorithm using the "MatchIt" R Package. For each survey respondent who participated in a co-op program, the algorithm matches a non-participant with the nearest propensity score that did not participate. The resulting dataset contains 2,316 matched pairs (1,158 co-op participants and 1,158 non-participants) after removing unemployed respondents. To validate that the matched dataset mimicked a controlled experiment, I calculated the difference in means for the treatment and non-treatment groups for each covariate. Ideally, I should not have been able to reject the null hypothesis that the difference in means is equal to 0. This was the case for almost all covariates except for level of education, where differences were significant at the 95 percent confidence level (Table A2). At a 99 percent confidence level, I do not reject the null hypothesis that the difference between the two groups is 0 for all covariates.

To estimate the effect of participation in a co-op program on incomes three years after graduation, I reran the OLS regressions using the matched subset of data (Table A3). The resulting estimates

Table A1: Estimating the Income Returns to Co-op Participation, Ordinary Least Squares Regression Results

	University				College				All			
	Estimate	Signifi-cance	Estimate	Signifi-cance	Estimate	Signifi-cance	Estimate	Signifi-cance	Estimate	Signifi-cance	Estimate	Signifi-cance
(Intercept)	39010.65	***	38788.66	***	34387.88	***	33771.91	***	29890.3	***	29610.75	***
Coop	4276.31	***	6149.58	***	56.48		3434.51	**	2035.53	***	4393.01	***
									12013.74	***	12020.57	***
Age	547.23	***	547.09	***	302.37	***	296.09	***	424.48	***	421.42	***
Minority	394.44		347.33		-289.69		841.16		189.35		471.8	
Imm	-2426.5	**	-2821.43	**	-3031.33	**	-2250.74	.	-2774.3	***	-2830.95	***
Female	-5611.01	***	-5184.68	***	-6258.5	***	-5441.32	***	-5888.42	***	-5382.64	***
Dep.kids	-556.38		-545.07		400.79		368.86		-33.8		-21.02	
Married	2314.95	***	2346.49	***	4685.96	***	4627.05	***	3254.22	***	3229.26	***
Education	1543.48		1546.56		3678.52		3808.73		2114.88	*	2125.17	*
Art	-6514.59	***	-6482.02	***	-472.4		-358.89		-3196.79	*	-3123.6	*
Social.Science	1421.28		1514.62		-349.13		-144.18		1271.34		1388.37	
Business	3370.92	***	3372.84	***	2112.68		2110.74		3601.04	***	3634.31	***
Science	-943.35		-882.66		3689.01		3775.26		-724.78		-688.68	
Math.CompSci	4973.44	*	4670.12	*	4135.74		4136.88		5531.36	***	5445.66	***
Engineering	10992.96	***	10626.89	***	12026.46	***	11940.68	***	12714.13	***	12412.9	***
Health	12656.73	***	12771.08	***	7898.23	***	7842.24	***	11101.29	***	11162.94	***
Other	4774.06	**	4803.5	**	1406.71		1513.14		3406.69	**	3485.88	**
Jobcl	-27239	***	-27265.63	***	-24009.84	***	-24101.26	***	-25888.56	***	-25956.13	***
Coop:minority			-330.68				-5538.27	*			-2232.92	
Coop:female			-3910.06	*			-3681.18	*			-3485.22	**
Coop:imm			2603.07				-2519.11				922.06	
R-squared	0.3187		0.3223		0.3251		0.3295		0.3424		0.3434	
Multiple R-Squared	0.3212		0.3193		0.3211		0.3248		0.3409		0.3415	
F-statistic	127.7 on 17 and 4588 df		109 on 20 and 4585 df		81.72 on 17 and 2884 df		70.78 on 20 and 2881 df		216.7 on 18 and 7489 df		186.4 on 21 and 7486 df	

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents with emplyment three years after graduation. Individuals graduating from a graduate level program are excluded. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table A2: Selecting and Validating Quasi-Experimental Dataset

	Propensity Score Estimation			Covariate Means in Matched Data		
	Estimate	Std. Error	Z-value	Non-Participants	Co-op Participants	P-value (difference)
(Intercept)	-1.89	0.05	-36.22			
Level	-0.60	0.01	-47.81	0.51	0.46	0.01
Age	-0.05	0.00	-41.97	26.18	25.89	0.24
Minority	-0.05	0.02	-2.74	0.23	0.24	0.61
Imm	0.35	0.02	18.39	0.18	0.19	0.53
Female	0.15	0.01	11.24	0.54	0.56	0.32
Mom.ed	-0.05	0.00	-14.53	1.75	1.61	0.07
Dad.ed	0.02	0.00	5.39	1.92	1.82	0.23
Dep.kids	0.02	0.01	1.75	0.36	0.34	0.44
Married	0.06	0.01	4.56	0.46	0.44	0.54
Education	1.31	0.05	26.77	0.05	0.04	0.63
Art	1.11	0.05	21.20	0.02	0.03	0.16
Social.Science	1.43	0.04	32.29	0.11	0.12	0.30
Business	1.95	0.04	45.34	0.30	0.30	0.95
Science	1.28	0.05	24.32	0.04	0.03	0.09
Math.CompSci	2.25	0.05	42.46	0.04	0.03	0.78
Engineering	2.49	0.04	56.00	0.24	0.23	0.29
Health	1.52	0.04	34.34	0.12	0.14	0.12
Other	1.51	0.05	31.59	0.07	0.06	0.35
Number of Observations	8013			1226	1226	2452

Notes: Regression includes the sample of graduates from the undergraduate level that participate in the labour force. Region of common support covers the majority of the estimated distribution:

$\forall i \in \{coop=1\}, P(coop) = [0.009,0.496]$, $\forall i \in \{coop=0\}, P(coop)=[0.009,0.486]$.

are generally similar to those from the unmatched regression estimates, but the estimated effect of co-op participation is higher in magnitude when using the quasi-experimental data, suggesting that the effect is likely underestimated when using the full sample.

Estimating the Effect of Co-op Participation on Non-wage Labour Market Outcomes

The National Graduate Survey asks respondents for information about their first job after school and their employment during the survey week (three years after graduation). These questions yield information about security of employment, whether respondents' first job was related to their field of study and whether or not their job provided extended health benefits, among other things. I used the responses to these qualitative questions, mapped to binary variables, to analyze whether participating in a co-op program is associated with higher likelihood of success in the labour market after school. The estimation employed logistic regressions that control for respondents' observable sociodemographic attributes and their field of study. The coefficient on the co-op variable can be interpreted as the probability of giving a positive response to the question of interest relative to non-participants. Dependent variables are coded as follows:

- first job is permanent: 1 = yes, 0 = no;
- first job relation to field of study: 1 = highly related, 0 = somewhat, not very, or not related;
- employment status, three years after graduation: 1 = full-time employed, 0 = part-time employed or unemployed;
- job offers extended health benefits: 1 = yes, 0 = no or unsure.

Table A4 shows estimation results for the pooled sample of graduates, while Tables A5 and A6 show the results for university and college graduates, respectively. To investigate if effects differ based on individual characteristics, I extended the analysis to add interaction terms for co-op participation with immigration status, gender and race (Table A7).

Table A3: Estimating the Income Returns to Co-op Participation, Ordinary Least Regression Results, Matched Quasi-Experimental Data

	University				College				All			
	Estimate	Significance	Estimate	Significance	Estimate	Significance	Estimate	Significance	Estimate	Significance	Estimate	Significance
(Intercept)	41140	***	40792	***	35426.13	***	33451.04	***	31661.8	***	30480.88	***
Co-op	4129	***	7808.7	***	2161.23		6360.91	***	3114	***	6816.31	***
Level									13833.44	***	13925.66	***
Age	386.6	**	360.9	**	168.72	*	170.01	*	251.76	***	245.33	***
Minority	0.9314		-522.5		-1095.33		2494.55		-609.06		419.25	
Imm	992.6		2286.6		-4773.24	*	-3352.52		-1339.57		-236.18	
Female	-4723	***	-1830.1		-5633.94	***	-2855.27	.	-5283.89	***	-2616.75	*
Dep.kids	-2059	.	-1908.4	.	1796.15	*	1800.08	*	391.43		412.02	
Married	2009	.	1897		2382.77	*	2098.61	*	2561.11	**	2428.08	**
Education	1262		416.8		1508.46		1108.03		1183.21		451.52	
Art	-8977	.	-9331.9	.	-1078.92		-1261.59		-5104.68		-5343.06	
Social.Science	-1028		-1452.2		2543.81		2449.31		778.35		369.43	
Business	5523		4872.5		1470.89		940.31		3961.7		3295.46	
Science	1076		400		9443.6		9399.47		1802.5		1119.79	
Math.CompSci	8634	.	7714.5	.	8320.89		8235.31		8859.72	*	8381.3	*
Engineering	13310	***	12376.6	**	15029.11	**	14925.57	**	14711.65	***	14139.22	***
Health	15320	***	14896.5	***	6008.62		5324.1		10046.07	**	9412.66	**
Other	2750		2053.8		2953.85		3016.99		3800.48		3501.04	
JOBCL	-26940	***	-27352.1	***	-23230.94	***	-23228.65	***	-25378	***	-25517.54	***
Co-op:female			-5965.8	**			-4927.35	**			-5082.2	***
Co-op:imm			-2399.2				-1448.65				-1666.33	
Co-op:minority			725.3				-7328.65	*			-2391.48	
R-squared	0.3287		0.3336		0.3435		0.3536		0.3704		0.3749	
Multiple R-Squared	0.3186		0.3218		0.3337		0.3423		0.3655		0.3692	
F-statistic	32.74 on 17 and 1137 df		28.38 on 20 and 1134 df		35.21 on 17 and 1144 df		31.21 on 20 and 1141 df		75.11 on 18 and 2298 df		65.56 on 21 and 2295 df	

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents with emplyment three years after graduation. Individuals graduating from a graduate level program are excluded. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table A4: Regression Results Estimating the Effect of Co-op on Non-Wage Labour Market Outcomes, Postsecondary Graduates

	First Job				Job in Survey Week (three years after graduation)			
	Permanent		Highly Related to Field of Study		Extended Health Benefits*		Full Time Employed	
Coefficients:	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**
(Intercept)	0.229	***	-1.928	***	-0.402	***	1.436	***
Coop	0.203	***	0.558	***	0.134	***	0.422	***
Level	-0.136	***	-0.140	***	0.414	***	0.407	***
Age	-0.006	***	0.046	***	0.013	***	-0.012	***
Minority	0.000		-0.323	***	0.291	***	0.044	*
Imm	-0.076	***	0.202	***	-0.325	***	0.140	***
Female	-0.110	***	0.022	.	-0.033	**	-0.625	***
Dep.kids	-0.064	***	-0.062	***	0.028	***	-0.046	***
Married	0.278	***	0.215	***	0.426	***	0.385	***
Education	-0.531	***	0.692	***	0.503	***	0.419	***
Art	0.163	***	0.362	***	-0.172	***	0.086	**
Social.Science	0.003		0.421	***	0.137	***	0.398	***
Business	0.656	***	0.699	***	0.917	***	1.033	***
Science	-0.478	***	0.573	***	-0.319	***	0.066	*
Math.CompSci	0.485	***	0.752	***	0.953	***	0.973	***
Engineering	0.464	***	0.978	***	1.352	***	2.103	***
Health	0.134	***	1.412	***	0.421	***	0.768	***
Other	0.097	***	0.639	***	0.577	***	0.842	***

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents in the labour force three years after graduation. Individuals graduating from a graduate level program are excluded. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. *Data restricted to sample of graduated with employment three years after graduation.

Table A5: Regression Results Estimating the Effect of Co-op on Non-Wage Labour Market Outcomes, University Graduates

	First Job				Job in Survey Week (three years after graduation)			
	Permanent		Highly Related to Field of Study		Extended Health Benefits*		Full Time Employed	
Coefficients:	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**
(Intercept)	-0.365	***	-2.183	***	-0.437	***	1.442	***
Co-op	-0.02		0.834	***	0.485	***	0.342	***
Age	0.011	***	0.05	***	0.029	***	-0.014	***
Minority	0.057	**	-0.283	***	0.487	***	-0.063	**
Imm	-0.273	***	0.146	***	-0.496	***	-0.23	***
Female	-0.03	*	0.124	***	-0.025		-0.416	***
Dep.kids	-0.034	*	0.124	***	-0.085	***	0.029	*
Married	0.261	***	0.123	***	0.596	***	0.356	***
Education	-0.675	***	0.549	***	0.427	***	0.278	***
Art	0.255	***	0.371	***	-0.406	***	0.131	***
Social.Science	-0.049	*	0.234	***	0.035	.	0.344	***
Business	0.814	***	0.737	***	1.618	***	1.228	***
Science	-0.462	***	0.501	***	-0.414	***	0.085	**
Math.CompSci	0.633	***	0.469	***	0.86	***	0.819	***
Engineering	0.403	***	0.826	***	1.348	***	1.463	***
Health	0.159	***	1.277	***	0.187	***	0.769	***
Other	0.016		0.541	***	0.983	***	0.305	***

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents in the labour force three years after graduation. Individuals graduating from a graduate level program are excluded. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

*Data restricted to sample of graduated with employment three years after graduation.

Table A6: Regression Results Estimating the Effect of Co-op on Non-Wage Labour Market Outcomes, College Graduates

	First Job				Job in Survey Week (three years after graduation)			
	Permanent		Highly Related to Field of Study		Extended Health Benefits*		Full Time Employed	
Coefficients:	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**	**Estimate**	**Significance**
(Intercept)	0.60065	***	-2.19719	***	-0.339886	***	1.312218	***
Co-op	0.40511	***	0.279141	***	-0.061448	***	0.512408	***
Age	-0.02428	***	0.040177	***	0.004551	***	-0.01736	***
Minority	-0.11194	***	-0.40793	***	0.059793	*	-0.55898	***
Imm	0.34886	***	0.217069	***	-0.178314	***	0.416337	***
Female	-0.18074	***	-0.1437	***	-0.077965	***	-0.51487	***
Dep.kids	-0.0625	***	-0.19679	***	0.133075	***	-0.17573	***
Married	0.26633	***	0.335811	***	0.297031	***	0.324765	***
Education	0.28989	***	1.63086	***	0.756256	***	0.270626	***
Art	0.14172	*	0.797516	***	0.306398	***	0.105452	.
Social.Science	0.29691	***	1.450279	***	0.591479	***	0.93238	***
Business	0.57436	***	1.194508	***	1.015941	***	0.73663	***
Science	0.08375		1.344809	***	1.121384	***	0.427415	***
Math.CompSci	0.47748	***	1.48953	***	1.168827	***	0.731165	***
Engineering	0.59024	***	1.526442	***	1.553394	***	1.267478	***
Health	0.22475	***	2.062625	***	0.838215	***	0.93541	***
Other	0.16515	**	1.189924	***	0.696754	***	0.802239	***

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents in the labour force three years after graduation. Individuals graduating from a graduate level program are excluded. *Data restricted to sample of graduated with employment three years after graduation for "health benefits" dependent variable regression. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table A7: Regression Results Estimating the Effect of Co-op on Non-wage Labor Market Outcomes – Individual Characteristic Interactions

	First Job				Job in Survey Week (three years after graduation)			
	Permanent		Highly Related to Field of Study		Extended Health Benefits*		Full Time Employed	
	Estimate	Significance	Estimate	Significance	Estimate	Significance	Estimate	Significance
(Intercept)	0.061201		-2.0978	***	0.0325795		1.546429	***
Co-op	0.416979	***	0.831504	***	0.0847643	***	0.115089	***
Age	-0.00553	***	0.046325	***	0.0102452	***	-0.01529	***
Minority	0.019262		-0.32012	***	0.3311545	***	-0.29928	***
Imm	-0.17575	***	0.153389	***	-0.3241029	***	0.002405	
Female	-0.05156	***	0.089633	***	-0.0602522	***	-0.50308	***
Dep.kids	-0.05548	***	-0.04851	***	0.0090403		-0.11779	***
Married	0.270438	***	0.204523	***	0.449553	***	0.385678	***
Education	-0.53784	***	0.688659	***	0.5037103	***	0.285607	***
Art	0.203789	***	0.406823	***	-0.3006086	***	-0.01236	
Social.Science	0.024668		0.446238	***	0.0940845	***	0.418054	***
Business	0.698699	***	0.745339	***	0.7947123	***	0.830551	***
Science	-0.47958	***	0.570823	***	-0.2978306	***	0.090287	**
Math.CompSci	0.540054	***	0.804454	***	0.8120771	***	0.632431	***
Engineering	0.518797	***	1.029401	***	1.1450078	***	1.138822	***
Health	0.203143	***	1.47906	***	0.2707312	***	0.709354	***
Other	0.189579	***	0.735765	***	0.3272043	***	0.444813	***
Co-op: Female	-0.35551	***	-0.42684	***	0.0172461		0.217518	***
Co-op: Imm	0.759933	***	0.270236	***	0.1437525	**	0.217256	***
Co-op: Minority	-0.44702	***	-0.16996	***	-0.2150591	***	0.44893	***

Notes: Regressions use data from the National Graduate Survey (2013) and includes respondents in the labor force three years after graduation. Individuals graduating from a Graduate level program are excluded. *Data restricted to sample of graduated with employment three years after graduation for "health benefits" dependent variable regression. Statistical significance is coded as: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

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