The Impact of Mandatory and Voluntary Work-Integrated Learning on Labour Market Outcomes

of Post-Secondary Students

by

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1 CONTENTS

2 INTRODUCTION

In recent years, there has been a great deal of interest by post-secondary institutions and governments in work-integrated learning (WIL): work placements that are a part of a student's degree or diploma. Rather than sitting in a classroom, students work with a business, government, or non-profit organization for course credit. The Canadian federal government announced in the 2021 Budget that they will be putting $947.8 million over five years towards funding work-integrated learning. The goals of such programs are to help students become job-ready, develop their hard and soft skills (Employment and Social Development Canada, 2018), and ease their entry into the labour market (Government of Canada, 2021; Employment and Social Development Canada, 2020).

The promotion of these programs by policymakers and institutions has, however, been made with the use of mixed evidence on whether WIL actually improves outcomes for students. Moreover, the evidence on the question of which types of WIL benefit students, as well as which students benefit the most from it is limited.

In this paper, I build a theoretical model of the decision to participate in WIL and utilize the full confidential 2018 National Graduates Survey (NGS) microdata to investigate these questions. I analyze how participation in mandatory WIL, voluntary WIL, and extracurricular experience in fields related and unrelated to one's field of study is associated with various short and medium term outcomes: length of time until one's first job, wages at one's first job, likelihood of being employed 3 years after graduation, wages 3 years after graduation, and how related one's job is to one's field of study 3 years after graduation. I employ OLS regressions and a propensity score matching technique to account for self-selection into WIL based on observables. I find that while

voluntary WIL and extracurricular work experience in a field related to a student's field of study are consistently associated with better outcomes for students, in most cases, I fail to find significant impacts of mandatory WIL that are robust to the propensity score matching design.

While there have been a number of descriptive studies that find evidence that WIL leads to better short or medium-run employment prospects for students, most existing studies fail to take into account a fundamental trade-off with WIL: since it often leads to delayed graduation and students doing work placements are often unpaid or paid below what they would earn as a graduate, WIL has an associated opportunity cost. Most studies tend to compare graduation cohorts, whereas what they ought to be comparing is enrollment cohorts; it's unsurprising that people with an extra year of work experience tend to have higher wages.

There is very little Canadian evidence on differential impacts of mandatory and voluntary work placements. A few international studies have found that voluntary work placements have a much larger or more significant impact on labour market outcomes than mandatory placements, and attribute this to signalling explanations of work placements as dominating over human capital explanations. If mandatory work placements are much less ineffective than voluntary ones, there are important implications for policy at the university and government level.

Furthermore, the literature on the impacts of co-op when compared to other forms of work experience is very limited. The benefits of work experience generally are intuitive and well-documented, but it may be that extracurricular student jobs offer different future benefits to students than co-op (through signalling mechanisms, for instance).

My paper fills these gaps in the literature in various ways. Firstly, what we ought to be considering when investigating whether co-op is beneficial to students is whether the opportunity

cost of the extra year's delay is worth the benefits. I take this trade-off into account in my theoretical model. I run OLS and propensity score matching regression techniques to investigate the impacts of co-op on a number of short-run labour market outcomes: time until graduates find their first job, wages at their first job, wages at their job three years after graduation, probability of being employed three years after graduation, and how well their job three years after graduation matches the field of their degree or diploma. I utilize my estimates from these outcomes to investigate whether or not the trade-off of delayed graduation with a potentially easier entry to the labour market benefits students monetarily or not; this has implications for whether or not governments and institutions should be encouraging and subsidizing WIL. Even if the trade-off is worthwhile, it is important to investigate how policies such as subsidizing work placements may impact various groups of people differently. Thus, I focus on whether there are heterogenous impacts of work placements for different groups. I also contribute to the literature by examining whether we find differential impacts of mandatory co-op, voluntary co-op, non-WIL work and volunteer experience during school, separating out how the impacts are different for work experience that is or is not related to the student's field of study. The estimates for these different independent variables differ in interesting and informative ways.

Terms common in the literature include internships and work placements, which can be extracurricular (not a part of a student's post-secondary education) or intracurricular (part of a student's post-secondary education; I often refer to these as WIL or co-op).

Section 2 is a review of the literature. I present a theoretical model of co-op in Section 3, describe the data and my methodology in Section 4, and present descriptive statistics in Section 5. I present results in Section 6. I then outline limitations in Section 7, and present my conclusion and discussion in Section 8.

3   LITERATURE REVIEW

Since the primary policy tool of encouraging the creation of co-op placements is employer wage subsidies, I begin by discussing the body of literature on the subject of wage subsidies generally and how they fare at improving outcomes for unemployed people. I then investigate a small body of literature looking at the differential impacts of more vocational or more general training at the secondary school level, before moving on to studies that specifically investigate the topic of interest to my paper: work placements for post-secondary students. This topic comprises of investigations of extracurricular, intracurricular mandatory and intracurricular voluntary work placements, a distinction that has different implications under various theoretical mechanisms for the impact of work placements on labour market outcomes.

Next, I look to different theoretical mechanisms behind WIL, and the empirical evidence comparing mandatory and voluntary work placements corresponds to the possible theoretical mechanisms. Finally, I draw out the theme of heterogeneity in the papers discussed throughout. Throughout, I also make references to the literature on the impact of work and volunteer experience on adults more broadly, outside of a post-secondary education (PSE) context.

3.1   WORK PLACEMENT SUBSIDIES

There is a body of literature on the impact of subsidized work placements as an intervention aimed at helping unemployed people find work. Systematic reviews have found that private sector employment subsidies lead to increased employment for unemployed adults (Kluve 2010; Borland 2014) and immigrants (Butschek & Walter, 2014) among other populations, and generally compare favourably with other active labour market interventions (such as job search assistance, direct employment in the public sector, and training programs). The research on the

impact of wage subsidies on youth in particular finds that they lead to higher employment rates and wages (Kluve et al. 2017; Webb et al., 2014). There are, however, questions raised in the literature about the heterogenous impact wage subsidies have on different groups (Borland 2014; Kluve et al. 2017). One concern in this domain of work is the possibility of spillover effects wherein a wage subsidy targeting one group decreases hiring for another (Webb et al., 2014).

The question most of these authors are asking is the following: does offering private sector wage subsidies lead to more employment for certain groups of people? Employment results in immediate impacts, such as money for the employed and a decreased reliance on other social supports for the duration of the job placement. The more nuanced and medium-term outcomes that I investigate in my paper concern whether employment in the form of job placements leads to improved labour market outcomes in the future, after the (potentially subsidized) job placement has ended.

3.2 VOCATIONAL VS GENERAL EDUCATION IN SECONDARY SCHOOL

Another body of literature that bears mentioning considers the impacts of incorporating vocational training into secondary schooling (rather than tertiary (post-secondary) education, as I focus on in this paper). Separating high school students into vocational and theoretical streams is common in some parts of Europe. Cabus and Haelermans (2015) use a Heckman selection model and Rubin matching model to document that participating in vocational training in secondary school leads to higher wages. Hanushek et al. (2017) and Golsteyn & Stenburg (2017) come to a more nuanced conclusion: though focussing on vocational training over more general education does lead to better short-term employment outcomes for students, it actually leads to worse outcomes in the long term. They point to the fast pace of technical change as rendering specific

5

vocational skills obsolete as people age. The authors reason that teaching more general and basic skills allows for better learning and mobility as the skills in need change.

As this paper focusses on short-run outcomes, it is outside its scope to comment on the topic of how co-op might impact long-run outcomes, but it would be an interesting idea to investigate for Canadian post-secondary studies. There are reasons to suspect that the trade-off of general-versus-specific skills might be different in this context. Firstly, the studies mentioned focussed on the risks of specializing in vocational training for younger secondary school students, whereas this paper discusses older students in post-secondary education. Furthermore, Canadian programs with co-op usually only reduce the more general or theoretical knowledge taught in the classroom by a small amount, often preferring to simply extend the length of the program to include one or multiple work semesters.

3.3   CANADIAN EVIDENCE ON WORK PLACEMENTS IN POST-SECONDARY EDUCATION

Next, I move on to the most relevant body of literature about how co-op, work placements, and internships impact labour market outcomes for post-secondary students. In general, the evidence on the topic is associative rather than causal; very few have an identification strategy for dealing with the endogeneity issue whereby more capable students are better at obtaining co-op positions, but also more likely to succeed in the labour market on those same merits. I begin by discussing results from Canadian papers, most of which offer descriptive and OLS regression analysis, and then move on to the limited literature, mostly international, with stronger identification strategies.

3.3.1 Intra-curricular

Canadian studies on co-op have largely utilized data from the National Graduates Survey (NGS). Walters & Zarifa (2008) analyze 2000 NGS data with OLS to find earnings premiums associated with co-op on the order of $2000 to $8000 annually. Ferguson & Wang (2015) use descriptive analyses of the 2013 NGS to find that co-op participants tended to report better job-education matches, had higher earnings, were less likely to return to school after their 2010 program and were more likely to have paid off their student debt 3 years after graduation.

Galarneau et al. (2020) also analyze the 2018 NGS with the view of exploring the impact of work-integrated learning on labour market outcomes. They use regression models to find that participating in WIL is not associated with a difference in the likelihood of being employed 3 years after graduation, but is associated with having one's job be a better match for their major and qualifications, as well as a 7% higher salary. As I also use the 2018 NGS, I replicate some of their results here in addition to adding my own theoretical and econometric work, such as utilizing propensity score matching and investigating heterogenous treatment effects of co-op on different groups.

Finnie and Myairi (2017) utilize linked administrative and tax data from five Ontario PSE institutions to analyze graduates from 2005 to 2012. They find, using descriptive and regression methods, that co-op participation is associated with sizeable earnings premiums between $1500 and $8000 for university and college graduates respectively. These earnings premiums persist and even widen in the medium run. This is in contrast to findings of other research (some of which have better identification strategies, but which do not take place in the Canadian context), which document that benefits of co-op dissipate in the medium to long run (Weiss, Klein, and Grauenhorst, 2014).

3.3.2   Extracurricular

The literature on WIL also fits into a larger literature on returns to work experience for students generally.

Martin and Rouleau (2020) use the Longitudinal and International Study of Adults to assess the impact of WIL and of extracurricular jobs related to the student's field of study (they refer to this as "informal WIL") on labour market outcomes for adults who graduated between 2012 and 2016. Their descriptive statistics show that students who had a job during their PSE were 21.2 percentage points more likely to find full-time employment within 3 months of graduation, and that those who held a job related to their field of study were 14.1 percentage points more likely to find full-time employment within 3 years of graduation when compared to their peers who held jobs not related to their field of study. The finding that employers place a premium on work experience even outside of students' fields speaks to how they value transferable soft skills, as well as that being a student with a job is in of itself a signal of being hard-working and motivated.

Frenette, Handler, & Chan (2021) analyze enrollment data from the PSIS, employer data from the Longitudinal Worker File, and family income data from tax data using OLS techniques to find that working at one firm during a student's studies and continuing to work at the same firm after graduation is associated with higher salaries two years after graduation, as well as higher chances of having an employer-sponsored pension plan and being unionized. This speaks to the importance of returns on firm-specific capital, as well as how an important benefit of doing a work placement as a student is the networks built and gained for future jobs.

3.4 DATA WITH MORE ROBUST IDENTIFICATION STRATEGIES

Fraser et al. (2006) investigate UK university students using a simultaneous equation model to allow for self-selection into a work placement program with a small business. They find that placements lead to a better likelihood of employment for students who otherwise may have had lower wages (based on factors such as gender, race, parental occupation, unemployment rates in their home regions), but did not find significant impacts for participants who were already more likely to have a higher wage.

I now turn to two resume audits: Nunley, Pugh, Romero, & Seals (2016) send resumes of fictitious college graduates to business-related jobs in the US. They find that having extracurricular internships listed on the resumes leads to higher call-back rates by 14%. Baert et al. (2021) run a similar resume audit in Belgium, but one focusing on students completing a Master's degree at a program where students can elect to do an internship for course credit. They found that students with the internship on their resumes were invited to the interview stage more often.

Students may be more or less likely to participate in WIL based on observable sociodemographic characteristics and field of study. Authors can estimate the probability that a student participates in WIL based on those observables, and use the estimated propensity score to match similar students who did or did not undertake WIL. This technique, called propensity score matching, can control for observable traits, but it does not allow economists to control for unobserved heterogeneity. Klein & Weiss (2011) utilize this method to examine the impacts of mandatory internships on job search duration to first significant job and log wages after 5 years, and do not find evidence of a significant impact. Weiss, Klein, and Grauenhorst (2014) more explicitly compare mandatory and non-mandatory internships, a topic which is discussed in more detail in

9

Section 2.8. They find that field-related and voluntary work experience leads to a shorter job search duration post-graduation, but do not find impacts on wages 5 years after graduation. Wyonch (2019) examines the 2013 Canadian NGS, also with a propensity score matching design. She looks at a variety of dependent variables, finding that co-op participation is associated with having one's first job be more closely related to one's field of study and develop into a permanent job, and that three years after graduation, co-op participants were more likely to be employed full time as well as to have better health benefits.

Margaryan, Saniter, Schumann, & Siedler (2020) exploit exogenous variation in mandatory internships in Germany. They find a 6% increase in short to medium-run earnings as well as a lower risk of unemployment in the first year post-graduation for students who completed a mandatory internship during their degree.

Verhaest and Baert (2018) use an instrument of distance from post-secondary institutions offering WIL for their identification strategy, and find no significant impact of WIL on the duration to students' finding their first job that is a good match for their education level.

We can see that evidence from studies that try to account for the endogeneity at play with work placements is more mixed than results from studies that do not.

3.5   THEORY

There are several theorized mechanisms by which work placements may improve the labour market outcomes of graduates.

Under human capital theory (Becker, 1964), doing a work placement allows students to build sector-specific practical skills and to develop more general professional skills such as time

management, professionalism, and social skills. Moreover, work placements may help students translate and make use of their classroom knowledge; one could consider classroom learning and practical experience as complementary types of capital.

Signalling theory (Spence, 1973), on the other hand, holds that the most capable and motivated students are the most likely to apply for and be chosen by companies for co-op placements. Thus, having work placement experience on their resume is a signal to employers of desirable but unobservable qualities. Frick and Malhaus (2016) extend this to screening theories as well, arguing that an internship with a top firm is more costly for low-ability individuals because the work is more difficult at a top firm.

Human capital theory may help explain why firms are more likely to hire work placement students after graduation and at higher wages (Frenette et al., 2015): the students have already invested in learning firm-specific capital, as well as the mix of transferrable skills needed for the job (Sattler and Peters, 2012). Those results are also consistent with models of on-the-job screening (Stiglitz, 1975), which hold that reliable information about a worker's productivity is costly to obtain. Businesses that have observed work placement students throughout their term do have access to that information, and, being able to distinguish which ones are high-ability types, are able to offer them higher wages upon their graduation. This is in line with qualitative research that businesses like having work placements students because it gives them a pool of potential employees who they have pre-screened (Sattler and Peters, 2012).

Under social network theory (Granovetter, 1973), work placements improve outcomes by increasing the network of young students. Potential employers trust information about candidates when it comes from their professional and social network, and students hear more about

available job opportunities through their networks, all of which may lead to improved labour market outcomes (Sattler and Peters, 2012).

A number of the discussed effects can be captured by search theory (McCall, 1970), where anything that reduces the uncertainty and lowers the cost of acquiring reliable information about a worker can lead to outcomes like higher job offer arrival rates for the worker. Also in line with search theory, benefits from WIL for students include building better job search skills (Gault et al., 2000).

WIL has also been documented to help students refine their career interests and preferences, form realistic expectations for work in their field, and help them plan for their future (Sattler & Peters, 2016; Margaryan et al., 2020; Wesley Routon & Walker, 2019).

I now turn to interesting themes or considerations that emerged from the data that require further investigation, stemming from heterogeneity in returns to work placements.

3.6 MANDATORY CURRICULAR, VOLUNTARY CURRICULAR, AND EXTRACURRICULAR STUDENT JOBS

Empirical studies that examine different types of jobs that students have can also be interpreted in light of the debate about whether human capital or signalling theories play a dominant role in explaining the premium of student work experience.

Under signalling theory, even if students worked at the same job and learned the same skills, employers would assign the most value to the work placement if it was extracurricular, less value if it was non-mandatory intracurricular, and no value if it was mandatory intracurricular. Voluntary work placements act as strong signals of students being ambitious and motivated, whereas mandatory work placements do not give that same signal.

Weiss et al. (2014) find that there are significant returns to voluntary internships but not mandatory ones, and attribute this to mandatory internships resulting in a reduced signalling effect.

In the resume audit with Nunley et al. (2016), the authors try to differentiate between human capital and signalling in their experimental design. Since the extracurricular internships were listed as taking place four years earlier, the authors argue that human capital gained in the position would have significantly depreciated by the time the applicant was seeking a job. Thus, they attribute the higher call-back rates to internships being signals of unobservables that are valued by employers, rather than supportive of human capital theory. They also find that post-graduation work experience, lasting 20-30 months and being more recent, only generated about twice the return as having had a 3-month internship four years ago. While the authors interpret this as further evidence in support of signalling over human capital theory, I think this could be interpreted in the human capital context of diminishing marginal returns on work experience. It may be that the first several months of work experience generate the highest returns in call-back rates because employees learn the most in the first months of their first job.

In a mixed methods study of employers' perceptions on graduates, Sattler and Peters (2012) find that employers do not believe there is a significant difference in skills between those with and without WIL experience, but they do find that employers offer graduates with WIL higher salaries, and attribute this to signalling effects.

The question of which of the two theories predominates has significant policy implications: if human capital holds, there is a good argument for encouraging WIL through continued government subsidies. If effects are primarily due to signalling, then the value of WIL is much

lower. The cost-benefit analysis of providing subsidies for promoting WIL should take into account that a significant part of the wage premium observed may be due to signalling effects.

In this paper, I will investigate whether there are differential effects of co-op on employment outcomes for mandatory and non-mandatory work placements.

3.7 HETEROGENEITY

One theme from the literature is that the benefits of co-op may not be the same for everyone. The returns to co-op are higher or only significant for people in certain disciplines, though the evidence differs on which disciplines. Wyonch et al. (2019) and Finnie and Miyairi (2017) in working with Canadian data find that co-op is associated with better and more significant returns for students in STEM fields, while Margaryan et al. (2020) in non-Canadian work but with more robust methodology find that returns are biggest in fields where employment is generally harder to obtain: humanities and social sciences. On the other hand, Baert et al. (2021) in their resume audit did not find the treatment effect to be heterogenous by student characteristics or to differ by field of study, and argue that their sample size should have been large enough to pick up on heterogeneity.

Margaryan et al. also find that effects are larger for students with a weaker "labour market orientation": they were more likely to have chosen their field without considering job prospects afterwards, and studied majors with more general skills (history, philosophy, languages) rather than a major that led to a specific job (i.e. medical school, accountant). They theorize that the co-op gave students who hadn't previously thought as much about what they would do post-graduation the chance to better understand jobs in their field and their own preferences, and that

personal contacts built from internships are more helpful with screening for potential employers when students' majors themselves are not a strong signal of where their abilities lie.

Some research has also looked at how co-op interacts with demographic characteristics that usually lead to a wage penalty. Members of visible minority groups and immigrants benefit more from co-op than white, Canadian-born peers (Wyonch et al., 2019).

It may be the case that the benefits of co-op are greater for new immigrants than for the general student population, since immigrants' first Canadian job experience seems to be very helpful in their labour market prospects (Oreopoulos, 2011). There are several different channels through which local work experience can be theorized to increase the portability of foreign-accrued human capital. Most notably, attending an educational program or working in the new country increases the immigrant's language abilities and locates their skills in a new cultural context by helping them gain institutional and cultural knowledge of their field in their new country. Thus, I pay particular attention to the possibility of heterogeneous treatment effects for recent immigrants in my analysis.

Meanwhile, there seems to be mixed evidence on the subject for women, with some researchers finding no evidence of heterogeneity in returns to co-op by gender (Baert et al., 2021; Margaryan et al., 2020), though Cozzi et al. (2017) finds in the case of volunteer experience that returns are substantially larger for men than they are for women. Margaryan et al. (2020) do not find evidence of heterogenous treatment effects by students' socioeconomic background (proxied with parental education) or ability (proxied with grades).

Autor et al. (2017) investigate the impact of job placements in the context of a welfare-to-work program, and use quantile regression to document substantial heterogeneity of job placements on

labor market outcomes across percentiles of the conditional earnings distribution: specifically, that there is no significant impact on the lower tail of the earnings distribution.

The question of whether work placements can help narrow wage gaps for groups that traditionally have worse labour market outcomes, or whether they simply give a leg up for students of already high ability has substantial implications for policy.

Furthermore, there is also evidence that not all work placement positions have the same benefits. Using OLS on German data, Frick and Maihaus (2016) do not find significant impacts of "standard" work placements on post-graduation wages, but do find wage premiums of 4-13% for students who undertook internships at top firms (as measured by a German blue-chip index). They attribute this to signalling effects associated with internships at well-known top firms being stronger. Another finding from Autor et al. (2017) is that work placements with temporary help agencies had no effect on labour market outcomes, while direct-hire placements did. Not all work placements help students gain the networking impacts from having a job, and not all work placements bridge easily into a full-time job upon graduation which, as Frenette et al. (2021) find, leads to better short and medium-term outcomes. In recognition of this evidence, universities and colleges need to assess the quality of their partnerships with local businesses for work placements, looking at the potential for networking opportunities as well as for the workplace to hire students as employees after they graduate.

3.8   SUMMARY AND GAPS

In sum, there are a number of descriptive studies that find that WIL results in significantly improved labour market outcomes. However, the limited number of studies with identification strategies that try to account for endogeneity have more mixed results. There are a number of

different proposed theoretical mechanisms for why WIL might result in improved labour market outcomes: the ones I will focus on here are human capital and signalling explanations. Papers tend to look at one of several related treatments: WIL generally, mandatory WIL, voluntary WIL, or extracurricular work experience. However, very few (and no Canadian) papers compare the different types. Potential differences in these measured treatment effects, such as only finding significant impacts for voluntary WIL but not mandatory WIL, may point to signalling mechanisms as dominating over human capital ones. Finally, there is evidence of heterogenous impacts of WIL on different groups, but results on whether and how effects differ by group are mixed.

4 THEORETICAL MODEL

In this section, I develop a simple search model, specifically drawing on Ferrall (1997) and Wolpin (1987). I aim to illustrate the trade off involved with choosing to do a work placement: there is an opportunity cost of doing so, but it can also be conceptualized as an investment in one's human capital that yields returns once graduated students enter the labour market. The modelling process involves a dynamic optimization problem, which is expressed and solved using Bellman equations, or value functions. Bellman equations break down the dynamic optimization problem into a sequence of smaller problems: they express the expected lifetime value associated with different decisions as the payoff from that choice in the current period, plus the value resulting from optimal decisions in future periods. I use discrete time: decisions in school are made yearly, and decisions after schooling is completed are made quarterly.

In students' second-to-last year of their post-secondary degree or diploma (T=0), they have the option of participating in a work placement (c=1) or not (c=0). Students leave school in period

$T(c) = 1 + c$. Thus, students who decide to not do co-op graduate a year earlier (T=1) than students who do undertake a co-op (T=2).

When students graduate, they enter a stationary job search phase where they are offered jobs with probability λ_c and wage offer distribution $F(w; c)$, where co-op results in a higher λ_c and more favourable wage offer distribution.

The quarterly discount rate is δ. Once they accept a job, agents have the job forever. Thus, the lifetime value of the job is $w + \delta w + \delta^2 w + \delta^3 w + \cdots = \frac{w}{1-\delta}$.

Let $EV(c)$ represent the expected value of searching for a job, and α_s be the utility (both monetary and non-monetary) derived from a period of job search.

$$\frac{w^*(c)}{1 - \delta} = \alpha_s + \delta EV(c)$$

In the equation above, $w^*(c)$ is the reservation wage: the wage at which the agent is indifferent between accepting the job and continuing to search for one more period. Thus, the LHS is the expected lifetime value of taking the job at the reservation wage, and the RHS is the expected value of searching for one more period.

We define $EV(c)$ as follows:

$$EV(c) = (1 - \lambda_c)\big(\alpha_s + \delta EV(c)\big) + \lambda_c F\big(w^*(c)\big)(\alpha_s + \delta EV(c)) + \lambda_c \int_{w^*(c)}^{\infty} \frac{w}{1 - \delta} f(w) dw$$

The expected value of being on the job market involves three possible events. In the first two cases: if the agent does not receive a job offer, or if they do receive a job offer but the wage offered is lower than the reservation wage, then their expected lifetime utility is the sum of the value of being unemployed that period plus the expected value of searching for a job next period.

In the last case, if they do receive a job offer and the value of the offer is greater than the reservation wage, they will receive the expected lifetime value of such a job offer.

Note that the reservation wage is higher for students who undertake a co-op position.

I denote the value of the student's last year in school, given their co-op decision as:

$$V_{T(c)}(c) = \alpha_u + \delta_u EV(c)$$

Where, since school periods are yearly and job search periods are quarterly,

$$\delta_u = \delta + \delta^2 + \delta^3 + \delta^4$$

and α_u is the utility a student obtains from a year of attending school.

Then, we also have that:

$$V_0(1) = \alpha_c + \zeta_1 + \delta_u V_1(1)$$

In the first period (T=0), the value for co-op students is the sum of α_c, the monetary and non-monetary utility derived from a year of coop; ζ_0, an IID extreme value shock; and the discounted value of their last year of school.

$$V_1(1) = \alpha_u + \delta_u EV(1)$$

The value of being in the second period for co-op students is the sum of α_u, the value of a year of schooling, and the discounted value of being on the job market next period.

$$V_0(0) = \alpha_u + \zeta_0 + \delta_u EV(0)$$

In the first period (T=0), the value for non-coop students is the sum of the value of being in school, ζ_0, an IID extreme value shock, and the discounted value of being on the job market next period.

Students choose to undertake coop if:

$$c^* = 1 \iff V_0(1) \geq V_0(0)$$

We also have that:

$$Prob(c^* = 1) = \frac{e^{V_0(1)}}{e^{V_0(1)} + e^{V_0(0)}}$$

This model is a mechanism for helping us to think about the central question of trade-offs when it comes to choosing to do a co-op. The placement itself has an opportunity cost since it delays entering the graduate job market: this is captured in the different discount factors. The return to co-op is then captured by the increased job offer arrival rate and better wage offer distribution once students enter the graduate job market.

As explored in the literature review, there may be heterogeneity in the returns to WIL; this could be captured by further heterogeneity in the job offer arrival rate associated with co-op and not doing a co-op, or in the potential wage distributions. In that case, it is less surprising that I find in my empirical analysis that there are significant impacts of WIL for voluntary but not for mandatory co-op: those who have the most to gain from co-op would select into it if it is voluntary, but if it's mandatory, the one treatment effect measured captures both those who benefit from co-op and those who do not.

5 Data

5.1 Data Description

I use the full, confidential 2018 National Graduates Survey (NGS) microdata through a Statistics Canada Research Data Centre. The NGS is a survey conducted in 2018 of people who graduated in 2015 from Canadian colleges and universities. Since it was conducted three years after students' graduation, the NGS contains variables about short-run labour market outcomes, such as wages and employment status, in addition to detailed information about respondents' 2015 post-secondary programs.

I will be investigating the impact of any work placement that is part of a post-secondary program, unpaid or paid. This includes components such as: co-op program, internship, practicum, clinical placement, field experience, community service learning. Some programs have mandatory work placements, while others recommend work placements and offer resources and connections with employers but do not mandate work placements for the completion of the diploma or degree. I count students as having done a work placement if the placement lasted 4 weeks or more.

5.2 Dependent Variables

Time to first job: The NGS questionnaire asks respondents to indicate the time from graduation until their first job in discrete categories of different length: already had a job upon graduation, fewer than 6 months, 6-12 months, 1-2 years, 2 years or more.

Wages: I investigate wages at respondents' first jobs and at their 2018 jobs. The measurement for wages is before taxes and deductions, but includes tips and commissions. The NGS allows

respondents to report yearly salaries or hourly wages; for those who reported hourly wages, I utilize those wage rates, the usual number of hours respondents report working in a week, and assume 48 weeks of work in a year to calculate yearly salary equivalents.

Employment status (2018): Respondents are asked whether or not they worked in the week before they completed the survey. They are categorized as being unemployed if they are actively searching for work; respondents out of the labour force are dropped from the sample.

Relatedness of 2018 job to 2015 program: Respondents were asked to indicate how related their 2018 job was to their 2015 program: 1 = closely related, 2 = somewhat related, or 3 = not at all related.

Program length: In order to get a sense of whether and by how much co-op extends the length of time required to complete a student's degree or diploma (and thereby help us get a sense of the opportunity cost), I also investigate the impact of co-op on the usual length of students' programs. Respondents are asked for the usual length of their program when it is taken full-time, and they respond by indicating one of the following ordered categories: less than 3 months, 3 months to less than 12 months, 1 year to less than 2 years, 2 years to less than 3 years, 3 years to less than 4 years, 4 years to less than 5 years, 5 years or more.

5.3 INDEPENDENT VARIABLES

The NGS asks students about several different types of work experience during their studies, which I contrast in my analysis: mandatory co-op, voluntary co-op, work experience related to one's field of study, and work experience not related to one's field of study.

They are asked if they completed any work placements as a part of their program, and are told this includes: "co-op program, internship, practicum, clinical placement, field experience, community service learning and other work placements that were part of your program." They are told to exclude "work placements or experiences that were not part of your program." I utilize this question to create the variable for whether or not a respondent undertook WIL during their studies. They are further asked about how long their longest placement lasted: I only count respondents as having participated in WIL if their placement was longer than four weeks. Those who completed a placement shorter than four weeks are in the sample as not having done a placement.

The mandatory/voluntary distinction is created using the following questions: Was that work placement a mandatory requirement to complete your [certificate/diploma/degree/certificate or diploma/certificate, diploma or degree]? Did you have the option to complete your [certificate/diploma/degree/certificate or diploma/certificate, diploma or degree] without participating in a co-op program?

Students are also asked: While you were enrolled in your program, did you ever work at a job or business? They are told to include work during the school year and work during the summer months, and to exclude work placements that were a part of the respondent's program. This ensures a clear distinction between extracurricular and intracurricular jobs. Students are also asked how closely related the jobs or businesses were related to their field of study, and given options of closely related, somewhat related, and not at all related. To maintain a smaller number of independent variables, I classify students who answered "closely" or "somewhat" related together in one category, as having had an extracurricular job related to their field of study.

5.4 SAMPLE

When examining employment status in 2018, the sample comprises of all respondents who are in the labour force at that time. We exclude people who respond that they are not in the labour force for this analysis, and only look at the likelihood of being employed versus being unemployed and searching for work.

For analyses with the remaining variables, the sample comprises of all respondents who have a job in the week of their 2018 interview, and provided a non-missing answer to questions about their first jobs' wage, time to first job, current job's wage, the usual length of their 2015 program, and how related their current job is to their 2015 education.

6 DESCRIPTIVE STATISTICS

Table 1 below presents descriptive statistics comparing the characteristics of those who did or did not do a work placement during their 2015 program. All descriptive statistics are weighted by the respondent's inverse probability of being in the sample to be representative of the population.

Table 1. Weighted Descriptive Statistics
Characteristics of populations who did and did not do a work placement

		Did a work placement?	
		No	Yes
Did a work placement?		54.4%	45.6%
Level of education	College	27.9%	44.0%
	Bachelor's	51.9%	44.5%
	Master's / Doctorate	20.2%	11.5%
% Women		53.7%	64.2%
% With a disability		22.6%	25.6%
% Married or common-law married		39.4%	42.3%
Median age at graduation		24	24
Immigration status	Non-immigrant	77.7%	83.7%
	Immigrated <5 years ago	6.7%	3.2%
	Immigrated 5-10 years ago	5.4%	4.7%
	Immigrated more than 10 years ago	10.2%	8.5%
% Visible minority		35.3%	26.3%
Program	Education	3.7%	10.7%
	Visual and performing arts, and communications	5.2%	3.3%

	Humanities	7.3%	1.6%
	Social and behavioural sciences and law	18.9%	14.1%
	Business, management and public administration	26.0%	17.7%
	Physical and life sciences and technologies	8.3%	2.5%
	Mathematics, computer and information sciences	3.9%	3.8%
	Architecture, engineering, and related technologies	14.1%	13.6%
	Agriculture, natural resources and conservation	6.3%	26.5%
	Other	6.3%	6.2%
Geographic region of studies	Atlantic provinces	5.4%	7.4%
	Quebec	25.4%	26.8%
	Ontario	42.6%	37.7%
	Western provinces, territories	26.6%	28.0%
Grade average	A+, A, A-	44.2%	50.2%
	B+, B, B-	47.6%	44.6%
	C+, C, C-, D+, D, D-	8.3%	5.2%
Had some work experience prior to starting 2015 program		83.7%	87.8%
Number of months until first job	already have a job	40.5%	34.3%
	<6 months	32.4%	44.6%
	6-12 months	9.0%	8.7%
	1-2 years	8.3%	6.4%
	2 years +	8.8%	5.4%
	still searching	1.0%	0.6%
Wages (first job)	1st quartile	22,880	24,570
(quartiles)	median	35,000	36,720
	3rd quartile	48,000	50,000
Wages (2018)	1st quartile	35,000	36,400
(quartiles)	median	48,000	50,000
	3rd quartile	65,000	65,000
Relatedness of 2018 job to 2015 program (conditional on being employed in 2018)	Closely related	44%	70%
	Somewhat related	27%	16%
	Not at all related	29%	14%
Usual length of program	3 to <12 months	11.3%	11.9%
	1 to <2 years	17.6%	16.6%
	2 to <3 years	22.3%	25.2%
	3 to <4 years	17.2%	19.2%
	4 to <5 years	30.1%	23.2%
	5 years or more	1.5%	3.9%
% had an extracurricular job during school in a field related to their studies		40.8%	38.6%
% had an extracurricular job during school in a field unrelated to their studies		35.0%	31.2%
Note: All counts and percentiles were rounded to the nearest ten.			

We can see in Table 1 that work placements are relatively common in Canadian post-secondary institutions, with 46% of students having taken part in a work placement through their post-secondary program. Work placements are most common at colleges, less common at university Bachelor's programs, and even less so at the Master's and Doctorate levels. More women do work placements; this may be due to mandatory work placements in women-dominated fields such as nursing and education. A smaller proportion of immigrants access WIL than their Canadian-born counterparts. It is also less common for people who identify as being a member of a visible minority group take part in co-op.

We do see large variation by program of study. People are more likely to do a work placement than not in education or agriculture and conservation; about equally likely to do or not do a work placement in mathematics and computer science or architecture and engineering; and unlikely to do a work placement in the arts and communication, the humanities, social and behavioural sciences, business and public administration, and physical and life sciences. People are more likely than not to do a work placement in the Atlantic provinces, and slightly less likely in the rest of Canada, though the regional variation is not too pronounced.

Students who complete work placements tend to have higher grades on average. We control for grades in our regressions later; as a rough proxy for ability, this may help control for some of the endogeneity of higher-ability or ambition students choosing to pursue and being chosen for limited work placement positions. A higher proportion of co-op students already had some work experience prior to even starting their 2015 program.

There is a higher incidence of taking over six months after graduation to find one's first job for respondents who did not take part in co-op, but those respondents were also more likely to report already have a job when graduating. People who did a work placement tend to have higher

26

wages at almost every quartile for both their first job and their 2018 job, tend to report that their

job three years later is more closely related to their 2015 program. The association of co-op with

program length is not clearly defined with just descriptive statistics. Most students had some

extracurricular job during their studies, with slightly more students having a job related to their

studies than one unrelated to their studies.

Table 2 below describes the work placements that respondents undertook.

Table 2. Weighted Descriptive Statistics About Placements

% Paid		27%
% Mandatory		64%
Duration of placement	>1 week	3.7%
	1-4 weeks	15.5%
	1-4 months	55.1%
	4-12 months	19.9%
	12+ months	5.8%

Only 27% of those students who participated in work placements indicated they were paid for at

least one of their placements. More than half had their placement be a requirement for

graduation. Most students had their placements be one semester or one year.

7 METHODOLOGY

I investigate the impact of co-op on labour market outcomes using two different main methods.

The first is simple OLS with robust standard errors (wages at first job, wages at 2018 job), probit

(2018 employment status), or ordered probit (length of time until respondents find their first job,

relatedness of 2018 job to 2015 program, program length). Note that I utilize log wages for the

independent variables of wages at respondents' first and 2018 jobs.

$$Y_i = \beta_0 + \beta_1 Coop_i + X_i' \beta_2 + \beta_3 Coop_i * Female_i + \beta_4 Coop_i * VisibleMinority_i + \beta_5 Coop_i *$$

$$RecentImmigrant_i + \epsilon_i \qquad\qquad (1)$$

I run the model in equation (1) above separately for mandatory and voluntary co-op as the independent variable of interest. Y_i represents a vector of dependent variables as previously discussed: wages at the respondent's first job, wages at the respondent's 2018 job, their 2018 employment status, length of time until respondents found their first job, relatedness of their 2018 job to their 2015 program. $Coop_i$ is an indicator for whether or not the respondent undertook at least one work placement of a length longer than four weeks. X_i' is a vector of control variables: gender, age, program, an indicator for whether they immigrated within the last 10 years, marital status, having a disability, age at graduation, the presence of children, education level of the respondent's mother, overall self-reported letter grade average during their program, and whether or not they are a member of a visible minority group, whether or not they volunteered in an extracurricular capacity during their program, whether or not they worked in an extracurricular capacity in a position related or not related to their field of study. Since previous research suggests that the returns to co-op can be different for different groups of people, I include interaction variables for co-op with $Female_i$, an indicator for whether or not the respondent was a woman; $VisibleMinority_i$, an indicator for whether or not they are a member of a visible minority community; and $RecentImmigrant_i$, an indicator whether or not they immigrated in the last 10 years (ie. after 2008).

I run the same regression for program length, but instead of looking at mandatory and voluntary coop separately, I just investigate the impact of coop generally on the usual length of a program.

OLS, however, misses in its analysis the fact that not everybody is equally likely to undertake a co-op. We can control for observable characteristics that form part of this self-selection problem with propensity score matching, a technique that works as follows: In theory, the difference between the outcomes a person would receive with or without co-op is the treatment effect. In

practice, we are always missing the counterfactual for a given person: if they chose co-op, we don't have information about what their labour market outcomes would have been if they had not chosen co-op and vice versa. Matching techniques constructs the missing counterfactual for a given person by taking the average of outcomes of people who were similar to them. In propensity score matching, we decide two people are similar not by matching people with, say, similar ages, but by looking at how likely they are to undertake co-op. We first estimate each person's probability of undertaking co-op given their observable characteristics, and the resulting likelihood is the propensity score. When we're matching people, we match people with similar propensity scores, or similar likelihoods of undertaking a co-op. The ATE can then be calculated using the average of the difference between the actual and constructed counterfactual outcome for each person. Propensity score matching can only control for selection on observable traits; it cannot account for unobservable traits (such as motivation or ability), which are very likely to have an important impact on both the decision to undertake co-op and on the outcomes being investigated. I implement this technique using Stata's *teffects psmatch*. Using this command, I match each observation to one observation receiving the opposite treatment that has the closest propensity score.

teffects psmatch does not allow us to examine heterogenous treatment effects for different groups in the same way, but I do utilize it to compare the impacts of mandatory co-op, voluntary co-op, work experience acquired during school (aside from a co-op) that is related to the student's field of study, and work experience that is not related to the student's field of study.

The mandatory/non-mandatory distinction here likely cannot be interpreted fully in light of signalling / human capital theories as a few previous studies have done. While there are some fields where WIL is mandatory at all Canadian colleges or universities in order for somebody to

gain a professional accreditation (i.e. nursing or teacher's college), there are other programs

where WIL is mandatory at some schools but voluntary at others. There may be a higher

entrance average requirement for a program with mandatory co-op, and thus even being able to

get into such a program can be a signal of ability to potential employers. That being said, we can

interpret extracurricular work experience and non-mandatory co-op as being stronger signals of

unobserved ability to future employers than mandatory co-op would be.

8 RESULTS

8.1 TIME TO FIRST JOB

Table 3. Effect of co-op on time to first job

	(1) Voluntary co-op		(2) Mandatory co-op	
	Coef.	SE	Coef.	SE
Coop	-0.06	0.05	0.01	0.04
Program of study				
Visual and performing arts & communications	0.25	0.05***	0.27	0.05***
Humanities	0.38	0.04***	0.39	0.05***
Social and behavioural sciences and law	0.29	0.03***	0.32	0.03***
Business management public administration	0.24	0.03***	0.26	0.03***
Physical and life science and technologies	0.61	0.04***	0.63	0.04***
Math computer and information sciences	0.38	0.05***	0.40	0.05***
Architecture and engineering	0.49	0.03***	0.50	0.04***
Agriculture natural resources and conservation	0.39	0.05***	0.41	0.05***
Health and related fields	0.25	0.03***	0.24	0.03***
Other	0.19	0.05***	0.20	0.05***
Single (marital status)	-0.08	0.02***	-0.08	0.02***
Has a disability	-0.02	0.02	-0.03	0.02
Level of education				
Bachelor's	0.14	0.02***	0.14	0.02***
Master's	-0.24	0.02***	-0.27	0.03***
Doctorate	-0.17	0.03***	-0.15	0.03***
Region of institution				
Quebec	-0.05	0.02**	-0.05	0.02**
Ontario	0.05	0.02**	0.05	0.02**
Western provinces and territories	-0.10	0.02***	-0.10	0.02***
Immigrated <10 years ago	0.15	0.03***	0.12	0.03***
Age at graduation	0.00	0***	0.00	0***
Female	-0.02	0.02	-0.02	0.02
Children	-0.17	0.02***	-0.17	0.02***
Mother's education	0.00	0	0.00	0

Grade point average				
B	-0.04	0.02***	-0.04	0.02***
C	-0.08	0.03**	-0.08	0.03**
No grade	0.04	0.03	0.04	0.03
Visible Minority	0.20	0.02***	0.22	0.02***
Female#Coop	-0.03	0.04	-0.04	0.04
VisibleMinority#Coop	-0.04	0.05	-0.08	0.05*
Immigrated <10 years ago#Coop	-0.15	0.08**	0.06	0.08
Bachelor's#Coop	0.11	0.05**	0.08	0.04**
Master's#Coop	0.19	0.06***	0.20	0.05***
Doctorate#Coop	0.07	0.08	-0.20	0.08**
Volunteer, related field to program	0.13	0.02***	0.13	0.02***
Volunteer, unrelated field to program	0.13	0.06*	0.13	0.06*
Work, related field to program	-0.74	0.02***	-0.73	0.02***
Work, unrelated field to program	-0.14	0.04***	-0.14	0.04***
Cut points	95% confidence interval		95% confidence interval	
/cut1	-0.26	-0.11	-0.25	-0.09
/cut2	0.91	1.06	0.91	1.08
/cut3	1.22	1.38	1.23	1.40
/cut4	1.62	1.78	1.63	1.80
Log likelihood	-29333.181		-29342.941	

Table 4. Marginal effects of co-op on time until first job

	(1) Voluntary Co-op		(2) Mandatory Co-op	
	dy/dx	z	dy/dx	z
Coop				
already have a job	-0.006	-0.610	-0.008	-0.97
<6 months	0.002	0.610	0.003	0.98
6-12 months	0.001	0.610	0.002	0.97
1-2 years	0.001	0.600	0.002	0.97
2 years +	0.001	0.600	0.002	0.96
Related extracurricular job				
already have a job	0.287	32.320	0.284	31.71
<6 months	-0.102	-25.840	-0.102	-25.45
6-12 months	-0.056	-26.540	-0.055	-26.16
1-2 years	-0.057	-26.200	-0.057	-25.79
2 years +	-0.072	-27.250	-0.071	-26.71
Unrelated extracurricular job				
already have a job	0.056	3.940	0.055	3.86
<6 months	-0.020	-3.920	-0.020	-3.85
6-12 months	-0.011	-3.920	-0.011	-3.85
1-2 years	-0.011	-3.920	-0.011	-3.85
2 years +	-0.014	-3.920	-0.014	-3.85

Coefficients from our ordered probit analysis are in Table 3 and marginal effects for key

treatment variables are in Table 4. I do not find significant impacts of either form of co-op on the

length of time until the respondent finds their first job. The cut points are distinct from each other; thus, the categories of time are distinct and do not need to be collapsed further.

Table 5. Propensity Score Analysis

	Dependent variable		Mandatory co-op	Voluntary co-op	Related extracurricular work experience	Unrelated extracurricular work experience
(1)	**Time until first job**	Coef	0.011	0.021	-0.389	-0.04
		SE	0.03	0.03	0.03***	0.07
(2)	**Wages at first job**	Coef	-0.01	0.04	0.29	-0.01
		SE	0.02	0.02**	0.02***	0.03
(3)	**Probability of being employed in 2018**	Coef	-0.238	-0.002	0.024	-0.020
		SE	0.01*	0.01	0***	0.02
(4)	**2018 wages**	Coef	0.00	0.04	10.49	0.01
		SE	0.02	0.01***	0.02***	0.02
(5)	**Relatedness of 2018 job to 2015 field of study**	Coef	-0.18	-0.09	-0.17	0.41
		SE	0.17***	0.02***	0.02***	0.04***

When I examine the outcome with propensity score matching in Table 5 model (1), I find that neither form of co-op has a significant impact on duration to first job, nor does extracurricular work experience unrelated to a student's field of study. However, with both the ordered probit and propensity score matching methods, I find that extracurricular work experience in a field related to a student's field of study results in a decreased amount of job search time before the respondent finds their first job.

8.2 WAGES AT FIRST JOB

Table 6. OLS Analysis of wages at first job

	(1) Voluntary co-op		(2) Mandatory co-op	
	Coef.	SE	Coef.	SE
Coop	0.07	0.03***	-0.03	0.03
Program of study				
Visual and performing arts & communications	-0.34	0.03***	-0.31	0.03***
Humanities	-0.31	0.03***	-0.27	0.03***
Social and behavioural sciences and law	-0.15	0.02***	-0.13	0.02***
Business management public administration	0.03	0.02	0.06	0.02***
Physical and life science and technologies	-0.17	0.03***	-0.13	0.03***
Math computer and information sciences	0.02	0.03	0.07	0.03**

	Coef.		Coef.	
Architecture and engineering	0.08	0.02***	0.11	0.02***
Agriculture natural resources and conservation	-0.11	0.03***	-0.07	0.03**
Health and related fields	0.18	0.02***	0.19	0.02***
Other	-0.06	0.03*	-0.03	0.03
Single (marital status)	0.04	0.01***	0.04	0.01***
Has a disability	-0.09	0.01***	-0.09	0.01***
Level of education				
Bachelor's	0.20	0.01***	0.18	0.01***
Master's	0.40	0.01***	0.39	0.02***
Doctorate	0.59	0.02***	0.57	0.02***
Region of institution				
Quebec	0.01	0.01	0.00	0.01
Ontario	0.02	0.02	0.03	0.02
Western provinces and territories	0.12	0.01***	0.12	0.01***
Immigrated <10 years ago	-0.05	0.02**	-0.05	0.02**
Age at graduation	0.00	0**	0.00	0**
Female	-0.08	0.01***	-0.09	0.01***
Children	0.07	0.01***	0.07	0.01***
Mother's education	0.00	0	0.00	0
Grade point average				
B	-0.04	0.01***	-0.04	0.01***
C	-0.14	0.02***	-0.14	0.02***
No grade	-0.02	0.03	-0.02	0.03
Visible Minority	-0.14	0.02***	-0.13	0.02***
Female#Coop	-0.03	0.02	0.04	0.02*
VisibleMinority#Coop	0.06	0.03*	0.00	0.03
Immigrated <10 years ago#Coop	0.04	0.05	0.01	0.06
Bachelor's#Coop	0.02	0.03	0.10	0.03***
Master's#Coop	-0.05	0.04	-0.01	0.03
Doctorate#Coop	-0.03	0.04	0.14	0.04***
Volunteer, related field to program	-0.06	0.02***	-0.06	0.02***
Volunteer, unrelated field to program	0.02	0.03	0.03	0.03
Work, related field to program	0.36	0.01***	0.36	0.01***
Work, unrelated field to program	0.09	0.02***	0.09	0.02***
Constant	10.29186		10.28288	
F	124.31		124.31	

Table 6 presents the OLS results for our regression on wages at the respondent's first post-graduation job, and while we do not see significant impacts of mandatory co-op on wages, we do see that voluntary co-op leads to increases in wages at one's first job of a modest magnitude. We do not find differential impacts of co-op for women, members of visible minority groups, or recent immigrants.

Using propensity score matching in Table 5 model (2), we confirm that there are significant impacts of voluntary co-op and related extracurricular work experience on wages at the respondent's first job.

8.3 LIKELIHOOD OF BEING EMPLOYED AFTER 3 YEARS

Table 7. Effect of co-op on probability of being employed in 2018

	(1) Voluntary co-op		(2) Mandatory co-op	
	Coef.	SE	Coef.	SE
Coop	0.01	0.07	0.06	0.06
Program of study				
Visual and performing arts & communications	0.15	0.07**	0.16	0.07**
Humanities	0.07	0.06	0.06	0.06
Social and behavioural sciences and law	0.26	0.05***	0.25	0.05***
Business management public administration	0.44	0.05***	0.45	0.05***
Physical and life science and technologies	0.19	0.05***	0.20	0.06***
Math computer and information sciences	0.37	0.07***	0.39	0.07***
Architecture and engineering	0.32	0.05***	0.35	0.05***
Agriculture natural resources and conservation	0.36	0.08***	0.37	0.08***
Health and related fields	0.62	0.05***	0.63	0.05***
Other	0.34	0.08***	0.35	0.08***
Single (marital status)	0.17	0.03***	0.17	0.03***
Has a disability	-0.16	0.03***	-0.16	0.03***
Level of education				
Bachelor's	-0.01	0.03	0.07	0.04*
Master's	0.10	0.04**	0.17	0.04***
Doctorate	0.09	0.05*	0.10	0.05**
Region of institution				
Quebec	0.11	0.04***	0.11	0.04***
Ontario	0.08	0.04**	0.09	0.04**
Western provinces and territories	0.15	0.03***	0.15	0.03***
Immigrated <10 years ago	-0.08	0.05*	-0.06	0.04
Age at graduation	0.00	0	0.00	0
Female	0.06	0.03**	0.04	0.03
Children	-0.04	0.03	-0.05	0.03*
Mother's education	0.00	0*	0.00	0
Grade point average				
B	-0.02	0.03	-0.02	0.03
C	-0.12	0.05**	-0.13	0.05**
No grade	-0.07	0.05	-0.06	0.05
Visible Minority	-0.21	0.03***	-0.23	0.03***
Female#Coop	-0.09	0.07	0.02	0.06
VisibleMinority#Coop	-0.11	0.09	0.08	0.08
Immigrated <10 years ago#Coop	0.08	0.12	-0.05	0.13
Bachelor's#Coop	0.25	0.09***	-0.10	0.07

	Voluntary co-op				Mandatory co-op	
Master's#Coop	0.17	0.11		-0.20	0.08**	
Doctorate#Coop	-0.03	0.13		0.32	0.16**	
Volunteer, related field to program	0.02	0.04		0.02	0.04	
Volunteer, unrelated field to program	-0.10	0.1		-0.10	0.1	
Work, related field to program	0.33	0.04***		0.32	0.04***	
Work, unrelated field to program	-0.01	0.06		-0.01	0.06	
Constant	1.16	0.06***		1.13	0.06***	
Log likelihood	-6774.8851			-6771.5926		

Table 8. Marginal effects of co-op on probability of being employed in 2018

	Voluntary co-op		Mandatory co-op	
	dy/dx	z	dy/dx	z
Coop	0.007	1.660	0.004	0.97
Related work experience	0.037	8.540	0.036	8.24
Unrelated work experience	-0.001	-0.160	-0.001	-0.22

In Tables 7 and 8, we see that there is no evidence significant at the 5% level of either OLS or propensity score analysis of co-op having an impact on the probability of a person being employed 3 years after graduation; not for the general population nor for subgroups of women, visible minority group members, or immigrants.

However, propensity score analysis and OLS find that work experience in a field related to one's field of study does increase one's chances of having a job three years after graduation.

8.4 WAGES AFTER 3 YEARS

Looking at the results in Table 9, I find that mandatory co-op actually is associated with lower wages after 3 years, while voluntary co-op is associated with higher ones. I do not find evidence of significant effects on women or immigrants specifically. However, I do find that voluntary co-op has a significantly larger impact on people who identify as being part of a visible minority group.

Table 9. Effect of co-op on 2018 wages - OLS

	(1) Voluntary co-op		(2) Mandatory co-op	
	Coef.	SE	Coef.	SE
Coop	0.08	0.02***	-0.05	0.02**
Program of study				
Visual and performing arts & communications	-0.29	0.03***	-0.25	0.03***
Humanities	-0.29	0.03***	-0.26	0.03***
Social and behavioural sciences and law	-0.10	0.02***	-0.07	0.02***
Business management public administration	0.06	0.02***	0.09	0.02***
Physical and life science and technologies	-0.16	0.02***	-0.12	0.02***
Math computer and information sciences	0.09	0.02***	0.13	0.02***
Architecture and engineering	0.08	0.02***	0.12	0.02***
Agriculture natural resources and conservation	-0.08	0.02***	-0.05	0.02*
Health and related fields	0.15	0.02***	0.16	0.02***
Other	0.01	0.03	0.03	0.03
Single (marital status)	0.06	0.01***	0.06	0.01***
Has a disability	-0.08	0.01***	-0.08	0.01***
Level of education				
Bachelor's	0.24	0.01***	0.21	0.01***
Master's	0.43	0.01***	0.43	0.01***
Doctorate	0.63	0.02***	0.60	0.02***
Region of institution				
Quebec	-0.01	0.01	-0.01	0.01
Ontario	0.08	0.01***	0.08	0.01***
Western provinces and territories	0.11	0.01***	0.11	0.01***
Immigrated <10 years ago	-0.01	0.02	-0.02	0.02
Age at graduation	0.00	0	0.00	0
Female	-0.10	0.01***	-0.11	0.01***
Children	0.04	0.01***	0.04	0.01***
Mother's education	0.00	0*	0.00	0*
Grade point average				
B	-0.05	0.01***	-0.05	0.01***
C	-0.14	0.02***	-0.13	0.02***
No grade	-0.04	0.02**	-0.05	0.02***
Visible Minority	-0.12	0.01***	-0.11	0.01***
Female#Coop	-0.02	0.02	0.06	0.02**
VisibleMinority#Coop	0.06	0.03**	0.01	0.03
Immigrated <10 years ago#Coop	0.01	0.04	0.06	0.05
Bachelor's#Coop	-0.01	0.03	0.11	0.02***
Master's#Coop	-0.03	0.03	0.00	0.02
Doctorate#Coop	-0.04	0.03	0.09	0.03**
Volunteer, related field to program	-0.06	0.01***	-0.05	0.01***
Volunteer, unrelated field to program	0.00	0.03	0.01	0.03
Work, related field to program	0.27	0.01***	0.27	0.01***
Work, unrelated field to program	0.08	0.02***	0.08	0.02***
Constant	10.57147		10.56985	
F	137.79		135.75	

However, using propensity score matching in Table 5 model (4), we do not find any significant results for mandatory or voluntary co-op on wages 3 years later. We do, on the other hand, find positive effects of work experience related to one's field of study.

8.5 JOB-EDUCATION MATCH

Table 10. Relatedness of 2018 job to 2015 field of study

	(1) Voluntary co-op		(2) Mandatory co-op	
	Coef.	SE	Coef.	SE
Coop	-0.31	0.05***	-0.11	0.04**
Program of study				
Visual and performing arts & communications	0.96	0.06***	0.77	0.06***
Humanities	1.15	0.05***	0.96	0.05***
Social and behavioural sciences and law	0.60	0.04***	0.47	0.04***
Business management public administration	0.33	0.04***	0.18	0.04***
Physical and life science and technologies	0.78	0.04***	0.57	0.04***
Math computer and information sciences	0.09	0.05	-0.11	0.05**
Architecture and engineering	0.32	0.04***	0.12	0.04***
Agriculture natural resources and conservation	0.53	0.06***	0.35	0.06***
Health and related fields	-0.16	0.04***	-0.17	0.04***
Other	0.42	0.05***	0.28	0.06***
Single (marital status)	-0.10	0.02***	-0.09	0.02***
Has a disability	0.13	0.02***	0.13	0.02***
Level of education				
Bachelor's	-0.02	0.02	0.00	0.03
Master's	-0.15	0.03***	-0.15	0.03***
Doctorate	-0.57	0.04***	-0.53	0.04***
Region of institution				
Quebec	-0.16	0.03***	-0.14	0.03***
Ontario	0.05	0.03**	0.04	0.03
Western provinces and territories	-0.11	0.02***	-0.11	0.02***
Immigrated <10 years ago	0.05	0.03	0.04	0.03
Age at graduation	0.00	0	0.00	0
Female	-0.09	0.02***	0.00	0.02
Children	-0.14	0.02***	-0.13	0.02***
Mother's education	0.00	0***	0.00	0***
Grade point average				
B	0.15	0.02***	0.14	0.02***
C	0.43	0.04***	0.41	0.04***
No grade	0.10	0.04**	0.12	0.04***
Visible Minority	0.20	0.02***	0.17	0.02***
Female#Coop	0.18	0.05***	-0.22	0.04***
VisibleMinority#Coop	-0.17	0.06***	-0.04	0.06
Immigrated <10 years ago#Coop	0.11	0.09	0.04	0.09
Bachelor's#Coop	-0.02	0.06	-0.29	0.05***
Master's#Coop	0.13	0.07*	-0.07	0.05
Doctorate#Coop	0.32	0.1***	-0.65	0.14***
Volunteer, related field to program	-0.09	0.03***	-0.09	0.03***

Volunteer, unrelated field to program	0.16	0.07**	0.12	0.07*
Work, related field to program	-0.28	0.02***	-0.34	0.02***
Work, unrelated field to program	0.41	0.04***	0.40	0.04***

Cut points	95% Confidence		Coefficient	
/cut1	0.44	0.61	0.28	0.46
/cut2	1.16	1.34	1.01	1.19
Log likelihood	-20594.2		-20437.336	

Table 11. Relatedness of 2018 job to 2015 education - marginal effects

	(1) Voluntary co-op		(2) Mandatory co-op	
	dy/dx	z	dy/dx	z
Co-op				
Closely related	0.060	7.450	0.138	19.28
Somewhat related	-0.020	-6.040	-0.057	-17.02
Not at all related	-0.040	-8.310	-0.082	-19.82
Related work experience				
Closely related	0.093	11.510	0.113	13.95
Somewhat related	-0.032	-11.450	-0.039	-13.82
Not at all related	-0.061	-11.410	-0.074	-13.77
Unrelated work experience				
Closely related	-0.138	-10.730	-0.134	-10.46
Somewhat related	0.048	10.580	0.046	10.32
Not at all related	0.090	10.700	0.088	10.44

We can see from the results of the ordered probit model in Table 10 that students who do a work placement during their 2015 program are more likely to be working in a job related to their field in 2018 for both mandatory and voluntary co-ops. I also present marginal effects in Table 11. On average, a person who does voluntary and mandatory coop is 6% and 14% more likely to say that their 2018 job is "closely related" to what they studied in their 2015 program. Looking to voluntary co-op specifically in model (1) of Table 10, we see that the treatment effect of co-op is larger for members of visible minority groups, not substantially different for immigrants, and actually smaller for women than for men. Cut points are statistically distinct for the various ordered categorical responses.

We see both in our probit analysis in Table 10 and propensity score matching results in Table 5 model (5) that having related work experience leads to a better match, but that work and volunteer experience that is unrelated to one's field of study lead to a worse match between one's

2018 job and 2015 field of study. This seems sensible; students may find it easier to find a post-graduation job in the field that they previously worked in. These results line up with previous research on the topic (Galarneau et al., 2020; Ferguson & Wang, 2015).

The significance of these treatments is robust when we use propensity matching techniques, as indicated in Table 5 model (5).

8.6 PROGRAM LENGTH

Work terms may delay graduation in some, but not all cases. For instance, consider a four-year university degree where students have the summers off. Doing co-op semesters during the summer would not delay graduation. However, if the program is structured so that students have a full-year co-op so that their program takes five years rather than four, then graduation is delayed and there is an associated opportunity cost to the co-op year.

Table 12. Impact of co-op on usual program length			
	Coef.	SE	z
Coop	0.43	0.03***	15.92
Program of study			
Visual and performing arts & communications	0.62	0.05***	12.40
Humanities	0.53	0.04***	12.50
Social and behavioural sciences and law	0.37	0.03***	12.21
Business management public administration	0.14	0.03***	4.81
Physical and life science and technologies	0.70	0.04***	19.38
Math computer and information sciences	0.40	0.04***	9.48
Architecture and engineering	0.36	0.03***	11.80
Agriculture natural resources and conservation	0.33	0.05***	7.02
Health and related fields	0.24	0.03***	8.36
Other	0.02	0.05	0.45
Single (marital status)	-0.01	0.02	-0.35
Has a disability	-0.04	0.02**	-2.13
Region of institution			
Quebec	-0.03	0.02	-1.27
Ontario	0.02	0.02	0.96
Western provinces and territories	-0.03	0.02*	-1.73
Had an extracurricular job	0.12	0.02***	5.18
Immigrated <10 years ago	-0.27	0.03***	-9.71

Children	-0.13	0.02***	-7.75
Mother's education	0.00	0***	-4.40
Grade point average			
B	0.23	0.02***	14.49
C	0.33	0.03***	9.73
No grade	-0.22	0.03***	-6.47
Visible Minority	-0.03	0.02*	-1.75
Bachelor's#Coop	-0.20	0.04***	-5.43
Master's#Coop	-0.35	0.04***	-8.9
Doctorate#Coop	-0.48	0.06***	-7.54
Level of education			
Bachelor's	1.92	0.03***	69.59
Master's	0.57	0.03***	21.04
Doctorate	3.63	0.04***	93.79

	Coefficient	95% Confidence interval	
/cut1	-0.28	-0.35	-0.21
/cut2	0.55	0.48	0.62
/cut3	1.63	1.55	1.70
/cut4	2.28	2.20	2.35
/cut5	4.03	3.95	4.11

Table 13. Marginal effects of coop on usual program length

	dy/dx	Std. Err.	z	P>z	[95% Conf.	Interval]
3 to <12 months	-0.038	0.003	-14.440	0.000	-0.043	-0.033
1 to <2 years	-0.019	0.001	-13.280	0.000	-0.022	-0.017
2 to <3 years	0.002	0.002	0.900	0.370	-0.002	0.007
3 to <4 years	0.009	0.002	5.630	0.000	0.006	0.013
4 to <5 years	0.038	0.003	11.520	0.000	0.032	0.045
5 years or more	0.008	0.003	2.880	0.004	0.003	0.014

Table 14. Effect of coop on usual length of program - propensity score matching

	Coef.	Std. Err.
Co-op	0.152	0.020***

Tables 12, 13, and 14 demonstrate that when examining the usual length of the program with either an ordered probit or propensity score matching, co-op is associated with a longer program length.

9 LIMITATIONS & ROBUSTNESS CHECKS

A substantial limitation of the analysis of time until first job is that the NGS asks about time until the respondent found their first job post-graduation, but that the first job may have been low-

paying and in a different industry from what the respondent studied for; simply meant to be a way to generate some income as they search for a job in their field that is a good match for their skills and interests. In an ideal data set, we would have data on when respondents obtained the first "quality" job—i.e. a job that is a good match for their skills and experience, full-time, where they spent more than six months working. Verhaest and Baert (2018) are able to use this better measure in their research. Table 15 below provides an overview of what percentage of respondents in our sample indicated that their first and 2018 jobs were full-time, and how related their first and 2018 jobs were to their field of study. We can see that the number of respondents who indicate that their job is "not at all related" to their field of study is about 5 percentage points higher when they are asked about their first relative to their 2018 job. Thus, while not being able to see when students obtained their first quality job is a limitation of our data, it is still a problem that only impacts a minority of the respondents. Further, when we stratify by whether or not students did coop, we see that there is a much larger change in the number of students whose job was "not at all related" to their field between their first and 2018 job for students who did not do coop. Thus, the time it took students who did not do coop to find their first quality job in their field is more underestimated here than it is for coop students. The impacts of coop on duration until students' first jobs are underestimated by our analysis, and would likely be larger in magnitude if we had data on when students found the first job in a field related to their field of study.

Table 15. Relatedness of first and 2018 job

		Total	No coop	Coop
First job	Closely related	53%	40%	68%
	Somewhat related	20%	24%	15%
	Not at all related	27%	36%	16%
2018 Job	Closely related	56%	44%	70%
	Somewhat related	22%	27%	16%
	Not at all related	22%	29%	14%

Propensity score matching relies on several assumptions in order to have a causal interpretation. Firstly, there is the assumption of overlap or common support, which is that each individual has a positive probability of receiving each treatment: that we have similar comparisons for each individual in the treatment and control groups. We can evaluate this assumption by comparing the traits of the populations who undertake co-op and do not undertake co-op. Our estimator reweights the data with the goal of achieving similar populations in the control and treated groups. We call this "balancing" the covariates. We can find evidence to support this assumption by looking at the difference in means between the treatment and control groups of each covariates as well as the ratios of their variances, before and after balancing. I was not allowed to release the results from the Statistics Canada Research Data Centre due to data confidentiality concerns, but after balancing, the difference of means is very close to zero, and the ratio of their variances is not too far from one. This suggests that our balancing exercise has helped us achieve common support.

Secondly, propensity score matching can account for selection into the treatment sample based on observable characteristics (i.e. students in certain programs are more likely to undertake co-op), but not unobservable ones. For instance, the decision to pursue co-op might be undertaken more by ambitious students, and in most post-secondary programs, the number of students outnumbers the number of available co-op positions, and so the students who perform best in interviews are the ones who are able to obtain a co-op position. In some programs, students who want to undertake co-op must maintain a certain GPA. While we control for a wide variety of factors in our regressions, including grades and parental education, there is likely substantial endogeneity that we cannot control for. The assumption of our outcome variables being exogenous to our treatment variables conditional on controls is not one that we believe to hold

here. The descriptive data gives us a profile of who in Canada is accessing co-op and informs us that access not even, but the regression results should be interpreted as suggestive of possible causal impacts, and in support of the need for further Canadian research with stronger identification strategies.

10 CONCLUSION & DISCUSSION

10.1 SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

I find that while the OLS and propensity score analysis of voluntary co-op yields significant improvements in wages at the respondent's first job, and wages 3 years after graduation, these improvements are not present when we utilize mandatory co-op as a treatment variable with propensity score matching specifications. Neither forms of co-op have an impact on a person's likelihood of being employed 3 years after graduation. The only significant result about mandatory co-op robust to propensity score matching seems to be that respondents who did mandatory and voluntary co-op are 14% and 6% respectively more likely to say that their job is "closely related" to their field three years after graduation. This is not necessarily a good thing in of itself as we do not see a corresponding increase in wages in the 2018 job; just as how it is not necessarily a bad thing that students who work an extracurricular job in a different field are more likely to have their 2018 jobs be in a different field, as it does not adversely affect their wages.

This paper also finds that paid WIL is the exception rather than the rule: at least 73% of work placements are unpaid. I was unable to find good systematic Canadian data on wages for work placement students, and so I turn instead to some illustrative data from the University of Waterloo (2020), which provides averages and ranges of wages earned by their co-op students.

For most programs, average wages are a few dollars above the minimum wage and considerably lower than market wages for graduates.

I also find that co-op results in a significantly longer program duration. This has an associated opportunity cost. A substantial minority of programs, however, may have that a co-op does not result in a longer program for students (i.e. placements are over the summers, or there is a 1:1 reduction in course-work semesters for co-op), and the opportunity cost in that case is not a problem. However, in many cases, the limited benefits and low wages paid during work placements mean that many students may not, on net, benefit monetarily from work placements. Note that in the model in Section 3, α_c represents both the monetary and non-monetary value of co-op: even if students do not benefit from co-op monetarily, it may be that they derive non-monetary value from the position. For instance, students may be sick of school and enjoy a change of pace for a semester or two before heading into their final year. This value is not something that this paper can measure.

That being said, however, there is reason to believe that for the highest-performing students in certain fields, firms bid wages up in an effort to attract the best students, and the pay is closer to that of an entry-level graduated employee. The University of Waterloo states that they have software engineering students doing co-op terms in the US who earn 80 USD/hour. In this case, co-op recruitment is likely a part of dominant US tech firms' overall recruitment strategies to attract the best talent, as many co-op students may choose to return there upon graduation. Where co-op positions are well-paid and/or do not result in a longer program length, students would reap potential benefits of co-op in labour market integration without as big of an associated opportunity cost.

Nevertheless, if the purpose of government-subsidized work placements for students is to help improve student outcomes, and the evidence is that they do not do so, or only do so in limited ways or only for certain people, and that moreover, there is often a substantial opportunity cost for students who undertake work placements, then policymakers ought to reconsider programs subsidizing and encouraging WIL. Programs that subsidize training costs for businesses hiring new graduates, for instance, may achieve the intended benefits of helping ease new graduates' transition into the labour market without potential opportunity costs associated with delayed graduation.

10.2 HETEROGENEITY

I did not find evidence for significant heterogenous effects of co-op for immigrants, but I did find that for respondents who identified as members of visible minority groups, co-op is associated with significantly higher wages, and that co-op has a larger treatment effect when it comes to how related the respondent's 2018 job is to the program that they studied in 2015. This conclusion is in line with other findings in the literature (Main et al., 2021).

At the same time, members of visible minority groups are underrepresented when it comes to doing work placements. This points to barriers they may face in accessing placements; likely the same barriers they face when it comes to finding good jobs after graduation. Researchers and policymakers should identify what those barriers are and how we can best address them to ensure equitable access to co-op.

It is also interesting that women may benefit less from co-ops than men. It may be that women are more likely to select into treatment, or that they do not make use of the possible advantages from co-op in the best way; studies have shown that women are less aggressive at pursuing

networking activities (Gregultez et al., 2019), and more likely to underplay their previous accomplishments (Lerchenmueller et al., 2019; Exley & Kessler, 2019), which could apply to when talking about previous accomplishments done during a co-op term in an post-graduation interview.

10.3 MANDATORY AND VOLUNTARY CO-OP

The impacts of mandatory co-op on labour market outcomes are very limited; the only significant impact that was robust to the propensity score matching specification was that it resulted in a 2018 job for students that was more related to their 2015 field of study.

There are several possible reasons for differences between outcomes of mandatory and voluntary co-op. The largest part of the difference is likely that students who obtain co-ops in a program where it is nonmandatory are likely the highest-motivation and ability students. The signalling explanation in this circumstance is weaker than usual because students do not need to and likely would not differentiate between mandatory and non-mandatory co-ops on their resumes or in interviews. Either way, the human capital built in a job should be the same if we believe treatment effects are homogenous; in a heterogenous treatment effects world, the people who choose to undertake co-op (voluntary) are those who would benefit most from it. In any case, these findings about mandatory co-ops on labour market outcomes are a call for further research into the topic. If their benefit to students is so limited, perhaps we should rethink the cost-benefit analysis of subsidizing co-op positions in post-secondary institutions.

10.4 DIRECTIONS FOR FURTHER RESEARCH

Since I am using the NGS, which only follows students three years after graduation, I am unable to investigate longer-term impacts of co-op. However, given some of the debate in the literature about whether the impacts dissipate in the medium to long run or not, as well as possible long-term detriments of focussing on specific vocational training over a flexible and adaptable general education, more research should be done about longer-term outcomes, perhaps by exploring new administrative educational and tax data sets.

An emerging and interesting theme throughout this paper has been that extracurricular work experience in a field related to one's field of study often has a larger or more significant impact on labour market outcomes than co-op does. Since it is not done for course credit, it may be that the most motivated or high-ability individuals are the ones who undertake extracurricular jobs, or that employers read that signal as strongest. This is particularly interesting because we often associate student jobs with less parental wealth (creates a need for students to supplement their income with part-time and summer jobs), as well as having less time to focus on one's studies. Further work in this area might be an interesting direction for future research.

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